

FM 44-8

DEPARTMENT OF THE ARMY FIELD MANUAL

**ANTIAIRCRAFT
OPERATIONS CENTER
AND
ANTIAIRCRAFT ARTILLERY
INFORMATION SERVICE**



DEPARTMENT OF THE ARMY • DECEMBER 1954

FOR OFFICIAL USE ONLY

FIELD MANUAL } DEPARTMENT OF THE ARMY
No. 44-8 } WASHINGTON 25, D. C., 3 December 1954

ANTIAIRCRAFT OPERATIONS CENTER AND ANTIAIRCRAFT ARTILLERY INFORMATION SERVICE

	<i>Paragraphs</i>	<i>Page</i>
CHAPTER 1. INTRODUCTION.....	1-3	3-4
2. AAA COORDINATION WITH OTHER AGEN- CIES		
Section I. Air defense responsibilities of each service.....	4-6	5-6
II. AAOC liaison—general.....	7-9	6-7
III. Agencies for liaison in zone of interior.....	10-13	8-13
IV. Agencies for liaison in the theater.....	14-17	13-22
CHAPTER 3. ANTIAIRCRAFT OPERA- TIONS CENTER		
Section I. General.....	18-21	23-26
II. Antiaircraft Artillery Opera- tions Detachment.....	22, 23	26
III. AAOC equipment and per- sonnel.....	24-26	28-45
CHAPTER 4. ANTIAIRCRAFT ARTIL- LERY INFORMATION SERVICE		
Section I. General.....	27-29	46-48
II. Personnel and equipment.....	30-32	48-50
CHAPTER 5. AAOC-AAAIS COMMUNI- CATIONS		
Section I. General.....	33-37	51-54
II. Radio communications.....	38-42	55-57
III. Wire communications.....	43-45	57-59

*This manual supersedes FM 44-8, 10 August 1944 and TC 28, 12 September 1951.

	<i>Paragraphs</i>	<i>Page</i>
CHAPTER 6. AAOC-AAAIS EMPLOYMENT AND OPERATION		
Section I. General-----	46-52	60-67
II. Operation of AAOC liaison with Air Force-----	53-57	68-73
III. AAAIS radars-----	58-64	74-82
IV. AAAIS observation posts-----	65-69	82-86
V. Operation of AAOC-----	70-72	87-91
APPENDIX I. REFERENCES-----		92
II. GLOSSARY-----		94
INDEX-----		102

CHAPTER 1

INTRODUCTION

1. Purpose and Scope

This manual sets forth the principles of organization and operation and the functions of the antiaircraft operations center (AAOC) and the antiaircraft artillery information service (AAAIS) (formerly intelligence service). These principles are set forth as a guide for the establishment of antiaircraft operations centers and antiaircraft artillery information services. Each antiaircraft defense will present a distinct problem which must be solved by the application of these principles modified as necessary to arrive at a sound solution. Problems arising and solutions to these problems will also vary widely between defenses in the zone of interior (the continental United States, ConUS) and those established in the theater of operations. Wherever these differences are pronounced, separate treatment will be given herein. The AAOC and AAAIS will also be discussed separately in this manual. In practice, they are closely related and supplement each other. The communication links among the agencies of a defense are indicated in general in figure 1. While figure 1 shows only automatic weapons and gun

units, the antiaircraft defense may consist of all types of antiaircraft artillery, including surface-to-air missiles.

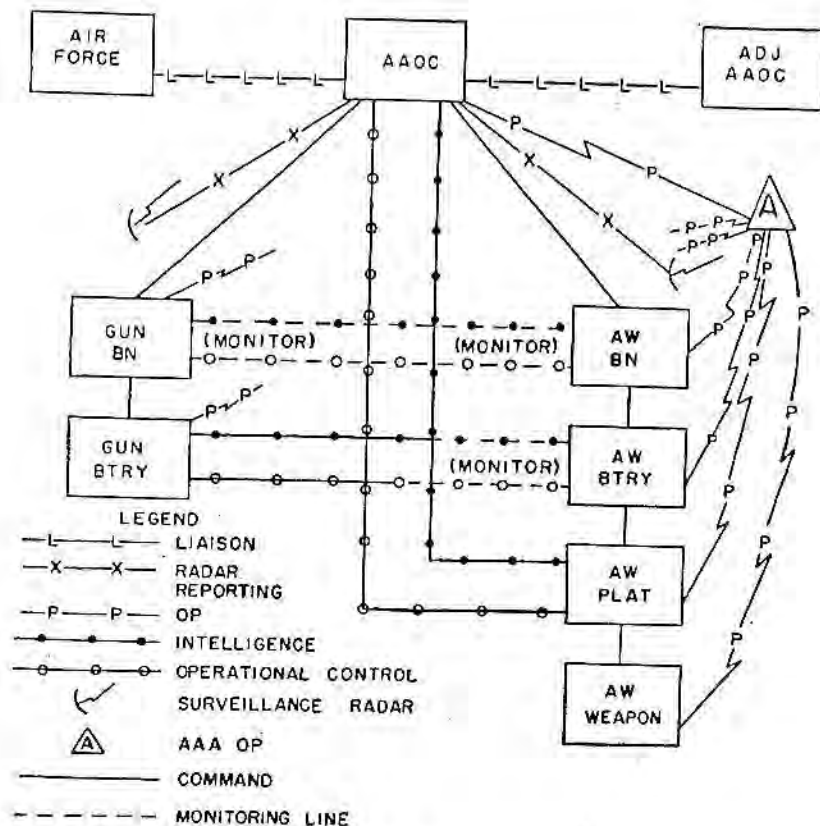


Figure 1. Antiaircraft artillery communication links.

2. References

See appendix I for list of publications pertaining to AAOC and AAAIS.

3. Definitions

See appendix II for definitions.

CHAPTER 2

AAA COORDINATION WITH OTHER AGENCIES

Section I. AIR DEFENSE RESPONSIBILITIES OF EACH SERVICE

4. Air Force Mission and Responsibilities

A primary mission of the United States Air Force is to defend the United States against air attack. With respect to air defense operations, the Air Force has specific responsibility for—

a. Organizing, equipping, and providing Air Forces for defense of the United States against air attack.

b. Organizing, equipping, and providing Air Force forces for land-based air defense, coordinating with the other services in matters of joint concern.

c. Formulating, in coordination with other services, joint doctrines and procedures for the defense of the United States against air attack.

d. Developing, in coordination with other services, doctrines, procedures, and Air Force equipment for air defense from land areas, including the continental United States.

5. Army Responsibility

With respect to air defense operations, the United States Army has specific responsibility for—

a. Organizing, training, and equipping Army anti-aircraft artillery units.

b. Providing Army forces as required for defense against air attack, in accordance with joint doctrines and procedures approved by the Joint Chiefs of Staff.

c. Developing, in coordination with other services, doctrines, procedures, and antiaircraft equipment for air defense from land areas, including the continental United States.

6. Navy Responsibilities

With respect to air defense operations, the Navy and/or the Marine Corps, as appropriate, have specific responsibility for—

a. Providing naval (including naval air) forces as required for the defense of the United States against air attack, in accordance with joint doctrines and procedures approved by the Joint Chiefs of Staff.

b. Providing sea-based air defense and sea-based means for coordinating control for defense against air attack; coordinating with the other services in matters of joint concern.

c. Developing, in coordination with other services, doctrines, procedures, and naval equipment for sea-based air defense of land areas, including the continental United States.

SECTION II. AAOC LIAISON—GENERAL

7. AAOC Liaison With Air Force

The antiaircraft defense commander (AADC) must establish liaison from his AAOC with the appropriate Air Force agency in order to obtain—

a. Early warning.

b. Identification.

c. Conditions of air defense warning.

d. Action status.

e. Identification, friend or foe (IFF) code changes.

f. Special flight regulations of interest to AAA.

g. Other information pertaining to friendly aerial activity.

8. AAOC Liaison With Navy

In general, the antiaircraft fire of naval vessels berthed at a pier and capable of providing this support will be placed under the operational control of the nearest AAOC. The antiaircraft fire of these ships will continue to be integrated with that of the land-based defense as long as the ships concerned remain immediately adjacent to the shore. The appropriate AAOC will establish direct liaison with them while this condition prevails. When naval vessels are underway or at anchor in the harbor, their antiaircraft fire will be under the control of the naval combat information center. Antiaircraft units of the United States Marine Corps may be placed under the operational control of an Army AAOC or may retain their autonomy, as higher joint headquarters direct.

9. AAOC Liaison With Other Army Agencies

In the zone of interior, AAOC liaison with other Army agencies will be conducted through such channels as higher headquarters may direct. In the theater, Army agencies with which the AAOC may establish liaison are discussed in paragraph 17.

Section III. AGENCIES FOR LIAISON IN ZONE OF INTERIOR

10. General

The antiaircraft defense commander in the zone of interior will establish liaison with the appropriate Air Force agency to obtain the data listed in paragraph 7. Appropriate Air Force agencies include the combat operations center (COC), the air division control center, and the direction center. Of these agencies, liaison will usually be established with the one closest to the AAOC in order to facilitate communications. Communications will generally be obtained through the use of commercial wire and radio facilities. Otherwise, the Air Force will generally furnish the necessary communications, which should be both wire and radio. When two or more Air Force agencies are within equal distance of the AAOC, liaison with a direction center is preferred because it will furnish the most up-to-date warning, the quickest identification, and the best operational data.

11. Air Division Combat Operations Center (COC)

The Air Division (defense) combat operations center is a part of the air division headquarters and is usually located adjacent to and as a physical part of a control center. It is the section of an air division (defense) which provides a command post for a specialized staff through which the air defense commander collects and evaluates information for the committing of forces provided for the air defense of a sector. Personnel of the COC include the division commander, director of combat operations, intelligence officer, fighter officer, antiaircraft artillery liai-

son officer, combat operations center duty officer, weather officer, liaison officers, and such other personnel as may be required. The functions of the combat operations center are to—

a. Exercise operational control over fighter units and antiaircraft artillery in defended areas and limited control over other air defense forces.

b. Supervise the control center in the operations of aircraft control and warning; supervise the ground observer and air defense warning systems, and the allocation thereto of elements of forces for air defense to satisfy current requirements.

c. Direct the employment of measures required to destroy or neutralize hostile aircraft.

d. Establish the requirements for point-to-point and air-ground communications necessary to employ operationally all elements of the sector air defense system.

e. Evaluate all available information on enemy and/or unidentified air movements in or toward the sector, and to disseminate pertinent intelligence through the air defense system and to civil and military agencies authorized to receive such intelligence.

f. Direct the issuance of air defense warning to key-point air defense warning centers and to certain military commanders in accordance with approved air defense warning plans.

g. Direct the use of measures to deceive, confuse, or deny aid to the enemy, as ordered by higher headquarters.

h. Designate the overall defense requirement for all air defense elements, including fighter units and antiaircraft artillery.

i. Implement plans for participation in the USAF collateral mission for the protection of the coastal waters of the United States, where geographical location of the assigned area of responsibility permits effective participation in such operations.

j. Coordinate operations with, and in support of, adjacent air division combat operations centers.

12. Control Center

A control center is an aircraft control and warning installation established to provide a display of information by which the aircraft, antiaircraft artillery, guided missile, and air defense warning functions of an air defense sector may be supervised and coordinated. The number of personnel required to operate a control center will depend primarily on the number of sources of information, air traffic, vital objectives, and subordinate units within the sector. During periods of light activity, many duties of personnel in the control center can be combined; however, a sufficient number of personnel must always be kept in reserve to operate all positions in an emergency. The control center provides facilities for the functioning of control, air surveillance, movements and identification, air defense warning, and liaison sections. The functions of a control center are to—

a. Collect and display pertinent information on air activities and the status of forces for air defense within a sector.

b. Disseminate specific air intelligence to the air division combat operations center (COC), adjacent control centers, subordinate direction centers, and other authorized agencies.

c. Monitor the implementing of movement-identification procedures as prescribed by pertinent directives.

d. Coordinate the passing of control of fighter aircraft from subsector to subsector.

e. Coordinate the activities of all other forces for air defense operating within the sector, exercising such control as has been delegated by the air division commander or his authorized representative.

f. Operate and maintain such point-to-point and air-ground communication facilities as are necessary in the collection of data and the dissemination of intelligence.

g. Provide operations information, records, and operations reports for the combat operations center (COC).

h. Provide such space, facilities, and information as are necessary to liaison representatives from the Army, Navy, Air Force and other authorized agencies that are assigned to duty with the sector at the control center.

i. Transmit air defense warning in accordance with approved air defense warning plans when so directed by the proper authority.

13. Direction Center

a. A direction center is defined as a radar installation able to perform air surveillance, identification, and air intercept control and to control the operation of those combative forces for air defense which are allocated to it. When modified, a direction center may serve as an alternate display facility for the combat operations center.

b. The capability of the direction center will depend primarily on the type of radar with which it is equipped, the number of sources of information, air traffic, and subordinate units within the subsector.

c. The direction center is normally organized into control, surveillance, movement-identification, communication, electronics, electronics countermeasures, and liaison activities.

d. The functions of a direction center are to—

- (1) Operate the surveillance equipment with which the installation is provided.
- (2) Collect, evaluate, and display pertinent information on air activities within the assigned subsector.
- (3) Disseminate specific air intelligence to the control center, adjacent direction centers, and other authorized agencies.
- (4) Identify air activities within or penetrating the subsector.
- (5) Scramble and control fighter aircraft for the air interception of targets.
- (6) Control fighter aircraft passed into the subsector by adjacent direction centers and to assist in the interception of designated targets when requested by the control center or adjacent direction centers.
- (7) Coordinate and control all other forces for air defense operating within the subsector, as directed.
- (8) Operate point-to-point and air-ground communication facilities used in the employment of allotted forces for air defense.

- (9) Order and maintain a specified condition of air defense warning for air defense forces assigned or allocated to the subsector.
- (10) Provide operations information, records, and operations reports to the control center.
- (11) Provide the necessary space, facilities, and information to liaison representatives from Army, Navy, Air Force, and other authorized agencies who are assigned for duty at the subsector.
- (12) Transmit air defense warning to specified military commanders in accordance with approved air defense warning plans, when directed by proper authority.
- (13) Assist friendly aircraft on air defense missions to avoid storms, hazardous terrain, restricted areas, and antiaircraft artillery defended zones.
- (14) Cooperate with and assist rescue units operating within the subsector.
- (15) Utilize all direct means to minimize or eliminate effects of jamming or interference caused by weather or electronic disturbances.

Section IV. AGENCIES FOR LIAISON IN THE THEATER

14. General

The appropriate Air Force agency for liaison in the theater will vary according to whether the AAOC is located in the combat zone (field army area) or in the communications zone. In the communications zone, liaison will generally be estab-

lished with either a direction center or a control center. In the army area, liaison will be with a joint operations center (JOC), an air control center (ACC), or a control and reporting center (CRC). Under special circumstances for local information and for limited periods of time, contact (not liaison) may be established with a target director post (TDP).

15. Communications Zone

In the communications zone antiaircraft artillery normally will be under the operational control of the air defense commander. Direction centers and control centers (pars. 12 and 13) are the appropriate agencies for liaison, with proximity being the determining factor when there is a choice of several agencies. The Air Force should provide wire and radio facilities for liaison.

16. Combat Zone

In the field army area, the antiaircraft artillery will be under the control of the appropriate artillery commander. Nevertheless, liaison must be established with the Air Force from the AAOC in order to take advantage of the air defense data (par. 7) which Air Force agencies are capable of providing. The principal joint agency available in the theater is the joint operations center (JOC). Air Force agencies ordinarily include the air control center (ACC) and the control and reporting center (CRC). In order to obtain specific information or specific aid, the target director post (TDP) or the air control team (ACT) may be utilized for short periods of time.

a. *Joint Operations Center (JOC)*. The joint operations center provides a facility at which both tactical air force and field army commanders may accomplish coordination necessary to insure full integration of all phases of air-ground operations. It is composed of staff officers from the tactical air force and the field army, or similar headquarters, and is located at a site near the two headquarters. In addition, all armed services and allied forces engaged in the joint action will participate through representation in the joint operations center. The joint operations center is composed of two sections, the combat operations section representing the tactical air force headquarters, and the air-ground operations section representing the field army headquarters.

(1) *Functions*. General functions of the joint operations center include—

- (a) Exchanging and disseminating information on the friendly situation and information and intelligence on the enemy.
- (b) Coordinating the processing, interpretation, and distribution of aerial photographs.
- (c) Providing an agency to which the army commander may present his requests for tactical air support.
- (d) Formulating and implementing detailed plans for employing air combat units.
- (e) Preparing for and conducting the daily air-ground planning conference.
- (f) Supervising the operation of the tactical air control system.

- (g) Arranging necessary coordination between field artillery, antiaircraft artillery, and surface-to-surface guided missile fire with the movement of aircraft within the tactical air force area of responsibility.
- (h) Disseminating weather information to ground force elements.
- (i) Coordinating common electronic services.
- (2) *Combat operations section.* The combat operations section is the Air Force part of the JOC. It is this section which is responsible for the performance of those JOC functions listed above which pertain to air activities. It is the agency through which the tactical air force commander assigns, supervises, and coordinates the air effort of forces assigned or attached. This section is an integral part of, and is staffed with personnel from, the tactical air force headquarters to include an operations section, an intelligence section, and such other personnel as are required to perform the necessary operations. The senior officer is the combat operations officer. He is the officer responsible for this section and simultaneously is the officer administratively in charge of the JOC.
- (3) *Air-ground operations section.* The air-ground operations section represents the field army in the joint operations center. It consists of a G2 air and a G3 air division, staffed respectively by personnel from the Army G2 and G3 sections. The G2 air

division is divided into a G2 air reconnaissance element and a G2 air target and intelligence element. Each division is responsible to the head of its general staff section. One or more artillery liaison officers will normally be on duty with the section to assist in fire coordination and other artillery matters.

b. *Air Control Center (ACC).* The ACC is the focal point for the aircraft control and warning activities of the tactical air force. It is an air information, communications, and control center and has no command functions other than those specifically delegated. Through this center, the tactical air force commander controls all air activity of the tactical air force.

(1) The functions of the ACC include—

- (a) Securing current information on all air operations, friendly and enemy, within the tactical air force area of responsibility.
- (b) Furnishing pertinent information on air activity to the joint operations center.
- (c) Directing the operations of CRC's, TDP's, CRP's (control and reporting posts), and other elements of the tactical control group.
- (d) Coordinating the active air defense facilities of the tactical air force with other air defense agencies in the tactical air force area of responsibility.
- (e) Scrambling air defense fighters. Except in emergencies, the ACC must get author-

ity from the combat operations section (tactical air force component of the joint operations center) to divert fighters from other missions to air defense.

- (f) Controlling aircraft on tactical air support missions as directed by the combat operations section. These activities may include warning friendly aircraft of hostile flights in their vicinity, vectoring friendly aircraft to primary or secondary targets, and vectoring friendly aircraft to subordinate control agencies which then assume control of the mission.
- (g) Providing navigational aid to lost or distressed aircraft.
- (h) Warning all interested agencies of impending air attack.
- (i) Coordinating with air-surface rescue agencies.
- (j) Coordinating with adjacent ACC's.
- (2) The ACC should be located immediately adjacent to the JOC.
- (3) ACC operating procedures as they pertain to air defense are—
 - (a) *Interception missions.* Air activity information received from reporting stations is plotted on the air surveillance plotting board of the ACC and forms the basis for defensive action when hostile flights are identified. When interception is advisable, fighters are vectored, as needed, for air defense. They may be scrambled or diverted from other missions, as necessary.

- (b) *Antiaircraft control.* Restriction and release of antiaircraft fire in the tactical air force and army areas of responsibility is coordinated with the AAOC, subject to such rules for engagement as may be prescribed in field army areas by the theater or equivalent commander or as may be agreed upon by the ground and air commanders.

c. Control and Reporting Center (CRC). A CRC is a subordinate air control facility of the ACC from which air control and air warning operations are conducted. It is organized and equipped on a small or large scale depending on its mission. Two or more CRC's normally are located separately within a field army and tactical air force zone of operations so as to provide maximum radar and radio control coverage. A modified CRC may fulfill the functions of both an ACC and a CRC for limited periods of time in a small area of operations or during the early stages of an airborne or amphibious operation.

- (1) Under the direction of the ACC, the functions of the CRC include—
 - (a) Controlling friendly in-flight aircraft.
 - (b) Forwarding information on friendly and hostile air activity to the ACC.
 - (c) Forwarding radar-plotted weather information to interested agencies.
 - (d) Providing navigational aid to friendly aircraft.
 - (e) Supervising the activities of TDP's and CRP's.

- (f) Maintaining point-to-point communications with designated air and ground elements of the tactical air control system.
- (2) Each CRC is located within an assigned area of responsibility at a site that will afford maximum utilization of radio and radar equipment. Normally, the CRC is located near enough to the front line to provide radar coverage and air-to-ground communications over frontline enemy territory. When required, control and reporting posts (CRP), and reporting posts (RP), equipped with lightweight radar, and ground observer teams (GOT), may be located at sites remote from the CRC to provide additional coverage.
- (a) Interception of hostile or unidentified aircraft will be carried out by controllers with fighters designated for the purpose by the JOC through the ACC. In an emergency, any fighters may be diverted for an interception.
- (b) Friendly flights are identified by the CRC through the use of special beacons or by having an intercept pilot fly a predetermined heading. The CRC then vectors the friendly aircraft toward the unidentified target. Upon making visual contact, the intercept pilot notifies the controller and identifies the target. The controller immediately relays to the ACC any information received from interceptor aircraft.

d. *Target Director Post (TDP)*. The TDP is a special control element of the tactical air control system. It performs no air warning service but is used to position friendly aircraft over predetermined target coordinates or other geographical locations under all weather conditions. This facility consists of a narrow-beamed radar with the necessary plotting and computer components and is designed to direct precision navigation and pinpoint all-weather bombing. The TDP must be highly mobile to allow movement into new positions according to the requirement of the tactical air mission.

17. Army Agencies for Liaison in the Theater

a. *Adjacent AAOC's*. Continual liaison between adjacent AAOC's of different units is important primarily as a source of combat intelligence to supplement that of organic and Air Force agencies. It is also valuable in comparing solutions to problems which are common to the AAOC's throughout the same theater. This liaison should be carried on between adjacent AAOC's even if they are of different levels of command. Whenever feasible, existing communication channels should be utilized for this purpose.

b. *Fire Support Coordination Center (FSCC)*. A fire support coordination center is an operating agency of the supported or force commander in which the representatives of the supported unit or force and the first support agencies work together to plan and coordinate fire support. It may exist at battalion, regiment, division, or corps levels. FSCC's generally are located within or immediately adjacent to the command post of the command for which fire

support is provided. Their personnel should include, whenever possible, a representative of the anti-aircraft artillery who will transmit to the appropriate AAOC's pertinent intelligence emanating from the FSCC.

c. Air Control Team (ACT). The ACT is an Army element, specially organized to direct close air support strikes in the vicinity of forward ground elements by visual methods. An Air Force forward air controller will be a member of the team. It is a highly mobile element having air-to-ground communication to guide aircraft to targets, and point-to-point communications with the necessary superior agencies.

CHAPTER 3

ANTIAIRCRAFT OPERATIONS CENTER

Section I. GENERAL

18. Primary Considerations

The AAOC is the tactical headquarters of the anti-aircraft defense commander. It is in this center that all of the information available to the anti-aircraft defense is collected, evaluated, and disseminated as intelligence. It is in this center and through this agency that the AADC exercises tactical control, under the operational control of the appropriate air defense commander, of all elements of the anti-aircraft defense. An AAOC is organized and operated by the senior (or designated) anti-aircraft artillery headquarters in the defense for each vulnerable area defended by anti-aircraft artillery. When an AAA brigade or group headquarters is present, an anti-aircraft artillery operations detachment (AAAOD) normally will be provided to equip and man the AAOC. When an AAAOD is not provided, the principles and procedures are the same, but the equipment must be partially improvised and the manning personnel must be drawn from the units of the defense.

19. Functions of AAOC

a. The AAOC coordinates all of the antiaircraft artillery available so as to engage an enemy with maximum effectiveness. To accomplish this, the AAOC has the following primary functions:

- (1) Collection and evaluation of information, and dissemination of intelligence.
 - (2) Exercise of tactical control, including fire direction, when and as necessary.
- b.* The secondary functions of the AAOC are to—
- (1) Act as a center for liaison and coordination with other agencies.
 - (2) Provide higher, lower, and adjacent headquarters with pertinent information.
 - (3) Make available warning of the approach of hostile aircraft for other arms and services to monitor with their equipment as they see fit.
 - (4) Provide the AADC with information on the effectiveness of the defense.
 - (5) Perform certain routine functions, such as the collection and dissemination of meteorological data, the preparation and maintenance of necessary statistics and records, and the submission of reports.
 - (6) Effect coordination of preparatory fire within the defense.
 - (7) Aid in training of all elements of the AAA defense.

20. Responsibility for Establishment of Primary AAOC

The AADC is responsible for establishment, organization, and operation of the AAOC. He nor-

mally delegates the duty of establishment, organization, and supervision to his executive officer. The AAOC of the AADC is known as the primary AAOC.

21. Alternate, Subordinate, and Information AAOC's (par. 52).

In addition to the primary AAOC, certain other types of AAOC's will be required.

a. The AADC will designate at least one other AAOC under his command (*c* below) as an alternate AAOC. Alternate AAOC's will be prepared to assume the functions of the primary AAOC in the event the primary AAOC goes out of action.

b. When the area of responsibility of the AADC is such that the primary AAOC cannot directly control all of the elements of the defense, subordinate AAOC's may be established. Subordinate AAOC's may assume operational control of certain designated fire units, under the direction and supervision of the primary AAOC. This decentralization is currently prescribed for zone of interior units under the implementation of sector control plan (par. 52*b*).

c. Headquarters subordinate to that of the AADC normally will establish information AAOC's. These information AAOC's will generally be established in all headquarters down to and including battalions. Information AAOC's are lower echelon operations centers containing one of the types of equipment listed in paragraph 24*a*, whose function is to keep the unit commander and his staff informed of the general air defense situation. In light antiaircraft artillery the battery command post (CP) is usually combined with one of the platoon CP's to form an information

AAOC. Battalion and group information AAOC's will be established as alternate AAOC's whenever possible. The number of these alternate AAOC's which can be established is usually limited by availability of equipment and the ingenuity of the AADC and his staff. Each information AAOC should always be capable of acting alone for all of the anti-aircraft defense elements within the defense in case of failures of the primary AAOC or its alternates. Information AAOC's have no operational control of their fire units or AAAIS radars as long as the primary AAOC or its alternates remain in operation.

SECTION II. ANTI-AIRCRAFT ARTILLERY OPERATIONS DETACHMENT

22. Mission of AAAOD

The AAAOD is a service unit which is organized to provide personnel and equipment to establish and man the AAOC under the direction of the unit to which the AAAOD is attached.

23. Equipment

Each AAAOD is equipped with either an operations center AN/TTQ-2 or a mobile operations center AN/MTQ-1 (fig. 2) and sufficient communications equipment to supplement that available in brigade or group headquarters in the establishment of an AAOC. In order to obtain maximum operating efficiency for the defense, groups and brigades need the equipment available in the AAAOD, or some other augmentation of the normal TOE.

OPERATIONS CENTER AN/MTQ-1

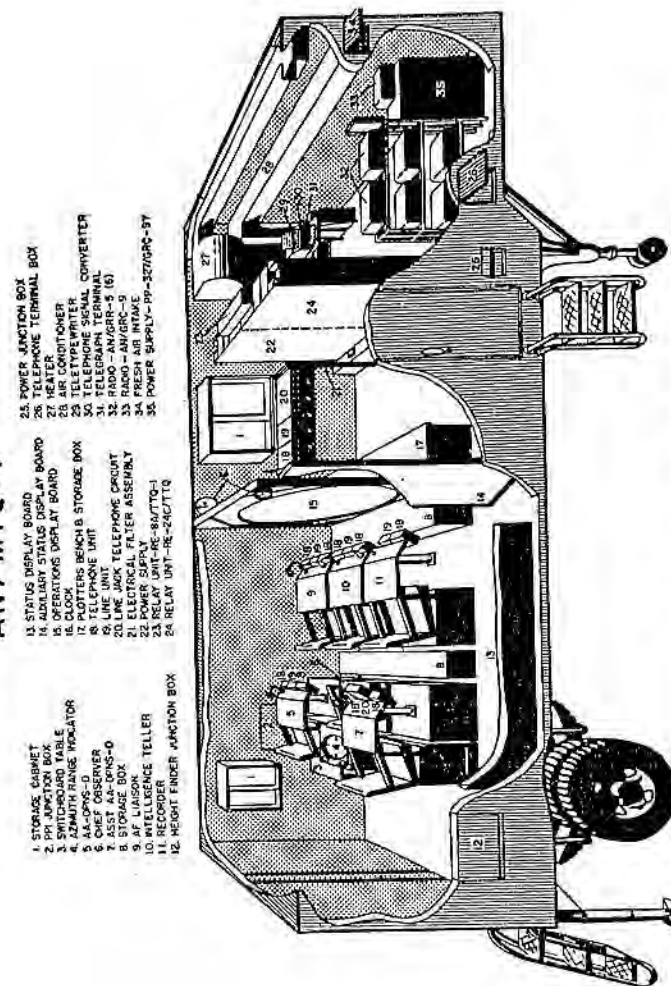


Figure 2. Operations center, AN/MTQ-1 (cutaway view).

Section III. AAOC EQUIPMENT AND PERSONNEL

24. Equipment Requirements

a. Certain equipment is required for the proper functioning of an AAOC. This equipment will vary with the type of unit as well as with the availability of authorized items. AAAOD's are currently authorized the mobile operations center AN/MTQ-1, but may be provided with the operations center AN/TTQ-2. AAA brigades and groups with no attached AAAOD's must improvise the necessary equipment. Many units have been authorized the electronic search central AN/GSS-1 (fig. 3). In

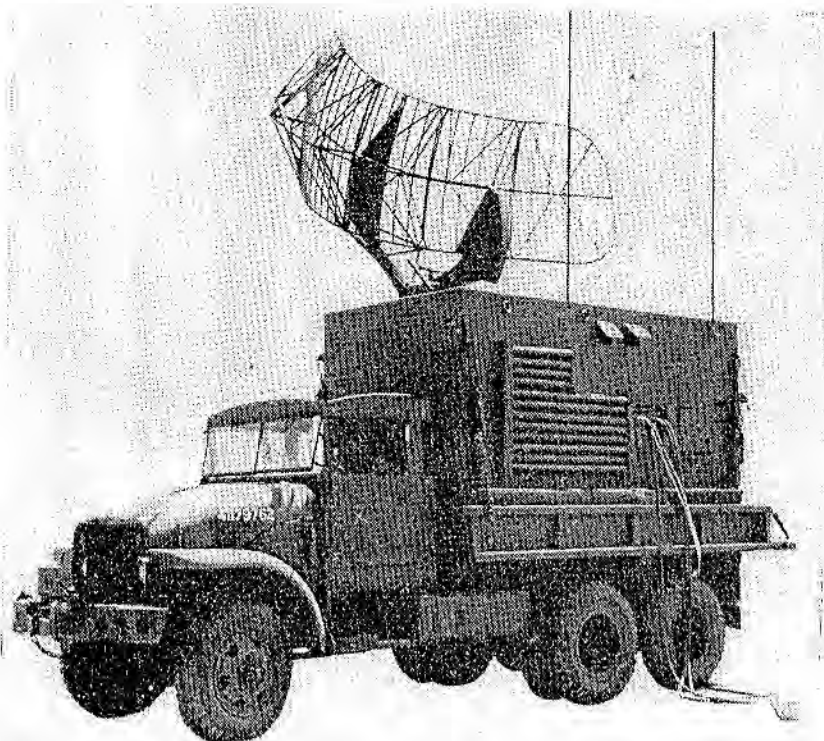


Figure 3. Electronic search central AN/GSS-1 (exterior view).

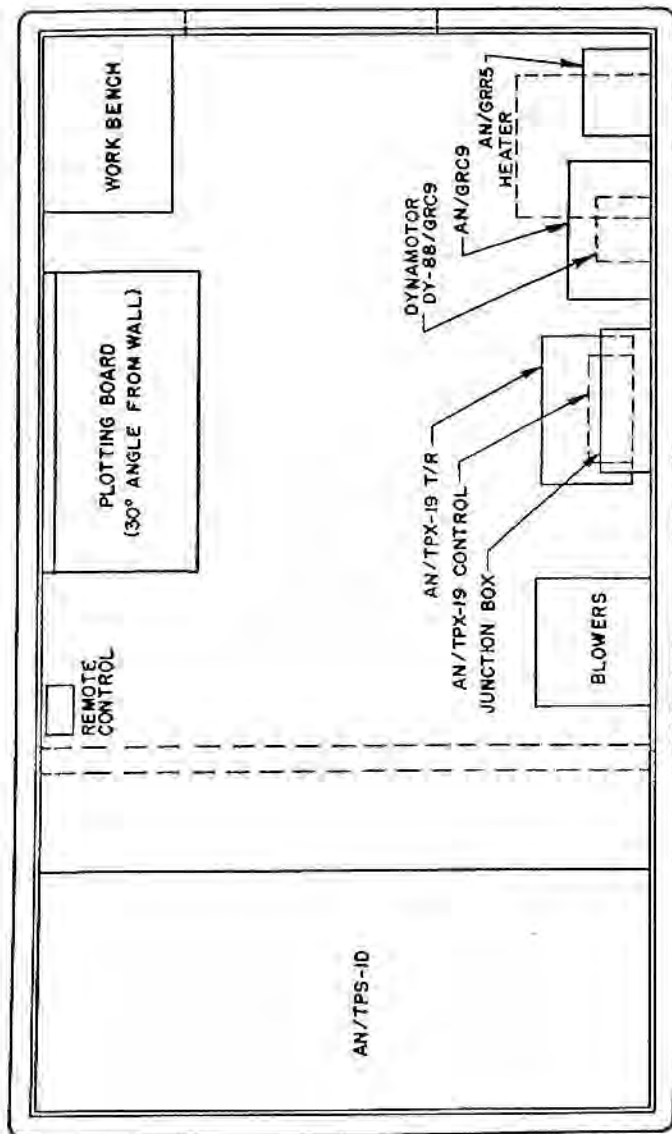
addition to the radar set AN/TPS-1D, this equipment (fig. 4) includes a shelter, a plotting board, and certain communication facilities, all of which can be used in establishing an information AAOC. The less elaborate radar data display board PT/171/PTS and plotting equipment AN/TSA-2 provide the minimum necessary equipment for the establishment of a battalion AAOC. Appropriate technical manuals should be consulted for detailed information on these equipments.

b. These various items of equipment require different techniques in their use, and units in the field will many times augment, modify, or alter the issued equipment to fit a local situation. Three basic manual plotting techniques may be employed.—

- (1) Horizontal plotting using small plastic arrows to indicate aircraft location and direction of flight (AN/TSA sets) (fig. 5).
- (2) Horizontal or vertical plotting on a plotting surface covered with plexiglass or acetate, using arrows drawn with china-marking pencils to indicate location and direction of flight (AN/GSS-1).
- (3) Vertical plotting on a side-lighted plexiglass or lucite plotting surface using china-marking pencils, with the plotting being done on the reverse side of the plotting board (AN/MTQ-1) (fig. 6).

c. Regardless of the echelon which establishes the AAOC or the type of equipment available, the following requirements exist:

- (1) *Communication.* Communication is undoubtedly the most important of these requirements and is covered in chapter 5.



AN/GSS-1
PLAN VIEW

Figure 4. Electronic search central AN/GSS-1 (plan view).

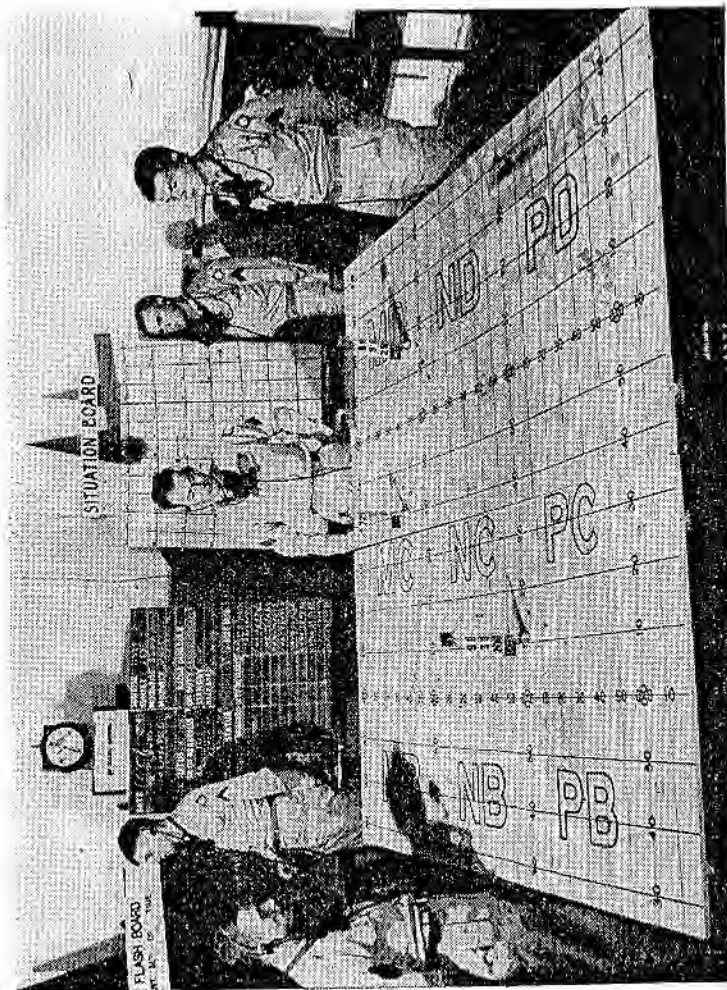


Figure 5. Typical AAOC in operation (horizontal plotting).

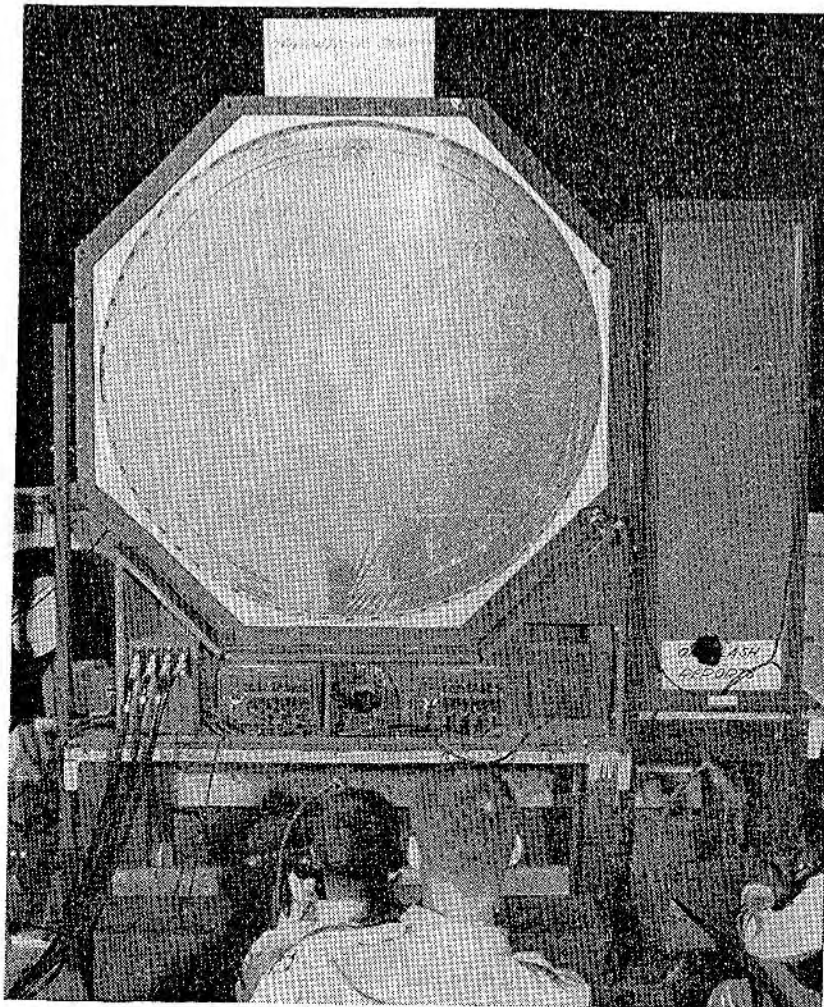


Figure 6. Operations board, AN/MTQ-1.

- (2) *Early warning.* Early warning is that warning which is furnished to the AAOC by the nearest Air Force control and warning agency. In the AAOC this warning will be plotted either in the early warning rings (par. 26a(2)) on the operations board (AN/MTQ-1), or on the situation board.

- (3) *AAAIS radar warning.* AAAIS radar warning is that warning which is furnished to the AAOC by the radars which compose the AAAIS radar system of local AA defense. In the AAOC this warning will be plotted on the operations board.
- (4) *AAAIS visual observer warning.* AAAIS visual observer warning is that warning which is furnished to the fire units of the AA defense and to the AAOC by the observers who compose the AAAIS visual observer system of the local AA defense. In the AAOC this warning will be recorded on the auxiliary data display board or recorded on the OP flash board. (In the zone of interior OP's are not usually employed, as this function is fulfilled by civilian ground observers.)
- (5) *Other warning.* Warning other than that discussed above (e. g., that from adjacent AAOC's) will be displayed in the AAOC as required by the local situation.
- (6) *AA defense status.* AA defense status is a variable that is dependent upon many items, for example, current equipment operating status, the location of hostile aircraft, the condition of air defense warning, the action status, or the condition of readiness. In the AAOC such items will generally be displayed on the status board or boards.

25. Personnel

a. *Antiaircraft Defense Commander (AADC).* For each AA defended area there will be an AADC. For

details on the responsibilities of the AADC see FM 44-1.

b. Antiaircraft Operations Officer (AAOO). Because it is not possible for the AADC to remain in the AAOC at all times, he appoints a staff officer to represent him and to exercise control of the elements of the defense during his absence. Since the time of an enemy attack cannot be foretold, the AADC may not be present in the AAOC at first indication of an enemy air raid. During such times, the AAOO on duty will make important decisions pertaining to the operation of the defense. In order that these decisions will more probably be acceptable to the commander, AAOO's will normally be members of the AADC's staff. When the AAAOD has been attached to one brigade or group for a period long enough for AAAOD personnel to be thoroughly familiar with the SOP and policies of the AADC, the officers of the AAAOD may be called upon to act as operation officers. The duties of the AAOO are important and should never be entrusted to officers who are not thoroughly familiar with AAOC procedure or with local doctrine. The AAOO's duties include, but are not limited to, the following:

- (1) Conducting the defense in the absence of the AADC.
- (2) Taking responsibility for operating the AAOC.
- (3) Evaluating information received by the AAOC.
- (4) Disseminating intelligence.
- (5) Exercising tactical control, including fire direction, when and as necessary. (Fire

direction includes, but is not limited to the following: selection of targets, the concentration or distribution of fire, the allocation of ammunition for each mission, and direction as to engagement or disengagement of targets.)

- (6) Insuring compliance with operational directives of the appropriate air defense commander.
- (7) Disseminating the condition of air defense warning.
- (8) Establishing the condition of readiness of the AA defense.
- (9) Obtaining the identification of aircraft from the air force control and/or intelligence agency and disseminating this intelligence to the elements of defense.
- (10) Supervising maintenance of journals.
- (11) Coordinating unit maintenance schedules in order to permit major items of equipment to be withdrawn from the defense for short periods without sacrificing the integrity of the defense.

c. Assistant AAOO. During busy periods, the AAOO may need an assistant. This assistant AAOO may be a junior officer and is frequently a member of the AAAOD. His duties include the following:

- (1) Providing relief for the AAOO as necessary.
- (2) Assisting the AAOO as directed in the exercise of his functions.
- (3) Performing such other duties as directed by the AAOO.

d. *Intelligence Teller.* The intelligence teller transmits pertinent aircraft track information displayed in the AAOC on the operations board to the elements of the defense. His duties include—

- (1) Transmitting intelligence as directed by the AAOC.
- (2) Assisting in maintaining journals as necessary.

e. *Operations Journal Recorder.* The operations journal in the AAOC is maintained by the operations journal recorder under the supervision of the AAOC. This journal should be in consonance with FM 101-5. The AAA after-action report will also be maintained by the journal recorder based on information received from the units.

f. *Chief Plotter.* To supervise the activities of all enlisted personnel on duty in the AAOC, a chief plotter is required. During his tour in the AAOC his duties include—

- (1) Insuring that status boards are properly posted.
- (2) Supervising the activities of the plotters and insuring that information is properly plotted.
- (3) Supervising the changing of enlisted personnel during the relief of the shift on duty.
- (4) Insuring that track stands for each track appear on the operations board (horizontal plotting only).
- (5) Assisting in reconciling EW information received from the Air Force with AAAIS plots.

- (6) Performing other duties as directed by the AAOC.

g. *Plotters.*

- (1) Through the AAOC communication system the radar plotters are connected to one or more surveillance radars. During periods of hostile air activity, one plotter normally is required for each surveillance radar in operation. During periods of lesser activity, one trained plotter can plot the information from more than one surveillance radar. Duties of the plotters are to—

- (a) Receive target information from surveillance radars.
 - (b) Plot locations of aircraft on the operations board.
 - (c) Place the track stand on the operations board adjacent to the plotting arrows to which the information pertains (horizontal plotting only), or verify that target information is correctly recorded on the information board (vertical plotting).
- (2) The early warning plotter has direct wire or radio communication with the Air Force Liaison agency. Duties of the early warning plotter are to—
 - (a) Receive intelligence concerning target locations from the Air Force.
 - (b) Plot locations of targets in the early warning rings on the operations board (AN/MTQ-1), or on the situation board.

- (3) The OP flash recorder (theater only) monitors the OP flash net and records pertinent target information on the auxiliary data display board (AN/MTQ-1) or on the OP flash board. As soon as the AAOC has had time to evaluate the message and take any necessary action, the OP flash recorder removes the information.
- (4) Other plotters may be necessary if data from other agencies are being received in the AAOC. Their duties will be determined by the situation.

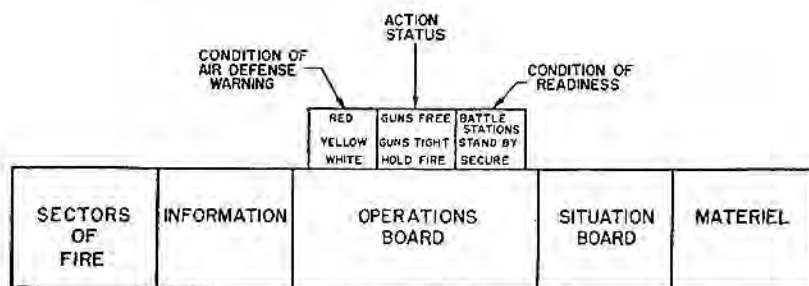


Figure 7. Example of AAOC data display (vertical plotting).

26. Equipment Description

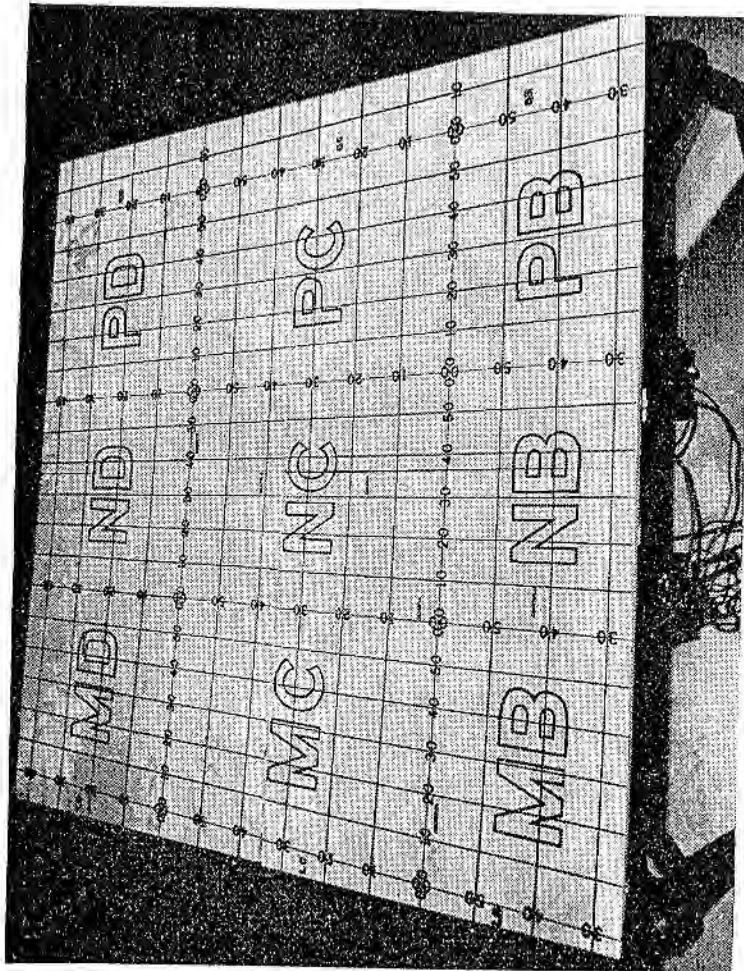
Every AAA officer must be thoroughly familiar with the characteristics of the major items of equipment within the AAOC. Figure 7 gives one possible arrangement of these items. Regardless of the methods used in any particular defense, the basic requirements for all defenses will be the same. Those items most frequently found include—

a. Operations Board.

- (1) The operations board is prepared specifically for each defense. It is a gridded

sketch map, the center of which is the vulnerable area that the AAA is defending (fig. 8). As the maximum rated range of the AN/TPS-1D radar is 160 nautical miles and the expected average effective maximum range is 120 nautical miles, the area to be included in the sketch should fall somewhere within these limits. The scale of the operations board will vary with the size of the board itself and the area which must be displayed. The area to be represented must equal that of the coverage of all local AAAIS warning sources. Only enough detail should be included on the sketch map to facilitate the functioning of the AAOC. The range capabilities of the individual units and the primary sectors of fire should be included. Too much detail tends to clutter up the board. The board must be large enough so that tracks and pertinent track data displayed on it can be easily viewed from any position in the AAOC.

- (2) If a single vertical plotting board is to be used (both as a situation board and operations board), the following is a recommended type found in the mobile operations center AN/MTQ-1. Three concentric early warning rings, each of a different color, will be circumscribed on the outer perimeter of the operations board. Each ring will be approximately one-eighth of an inch wide, with 1 inch of space between rings, and will



be graduated at each 100 miles in azimuth. In operation, these rings will represent an addition to the radius of the operations board to allow the plotting of warning which is beyond the range of the operations board proper.

- (3) Communications outlets are available at the operations board for all radar reporting nets, Air Force early warning nets, and any other nets over which plots may be received.

b. Information and Auxiliary Data Display Boards. An information board (fig. 9) is frequently found in the AAOC to display track data which cannot conveniently be displayed on the operations board. The auxiliary data display board is found in the AN/MTQ-1 operations center and may be used

[illegible]

Figure 9. Typical information board.

to display OP flash messages as well as track data.

c. Track Stands. When horizontal plotting techniques are used, the track stand will be used to display track data. Track stands (fig. 10) are issued as a part of the TOE equipment to certain units. They may also be improvised.

d. Status Board. The operating status of units in the AA defense and other general data pertinent to the defense are posted on the status board. The use and design of the board depends upon the individual requirements of the particular AAOC. The board, of any convenient size, is mounted vertically so that it can be read from all parts of the operations center. Frequently several boards are utilized to display the necessary information. Information which may be shown on the status board includes—

- (1) Date.
- (2) Materiel status (fig. 11).
- (3) Meteorological data.
- (4) Time of sunrise and sunset.
- (5) Time of moonrise and moonset.
- (6) Operational schedule of radars.
- (7) Current aircraft recognition and identification signals.
- (8) Action status of the elements of the defense
- (9) Units presently engaging targets.
- (10) Convoy information (for port defenses).
- (11) Friendly aircraft missions.
- (12) Condition of air defense warning.
- (13) Condition of readiness.
- (14) Name of AAOO on duty.

Note. The above information may be shown entirely on one board or may be located on several boards.

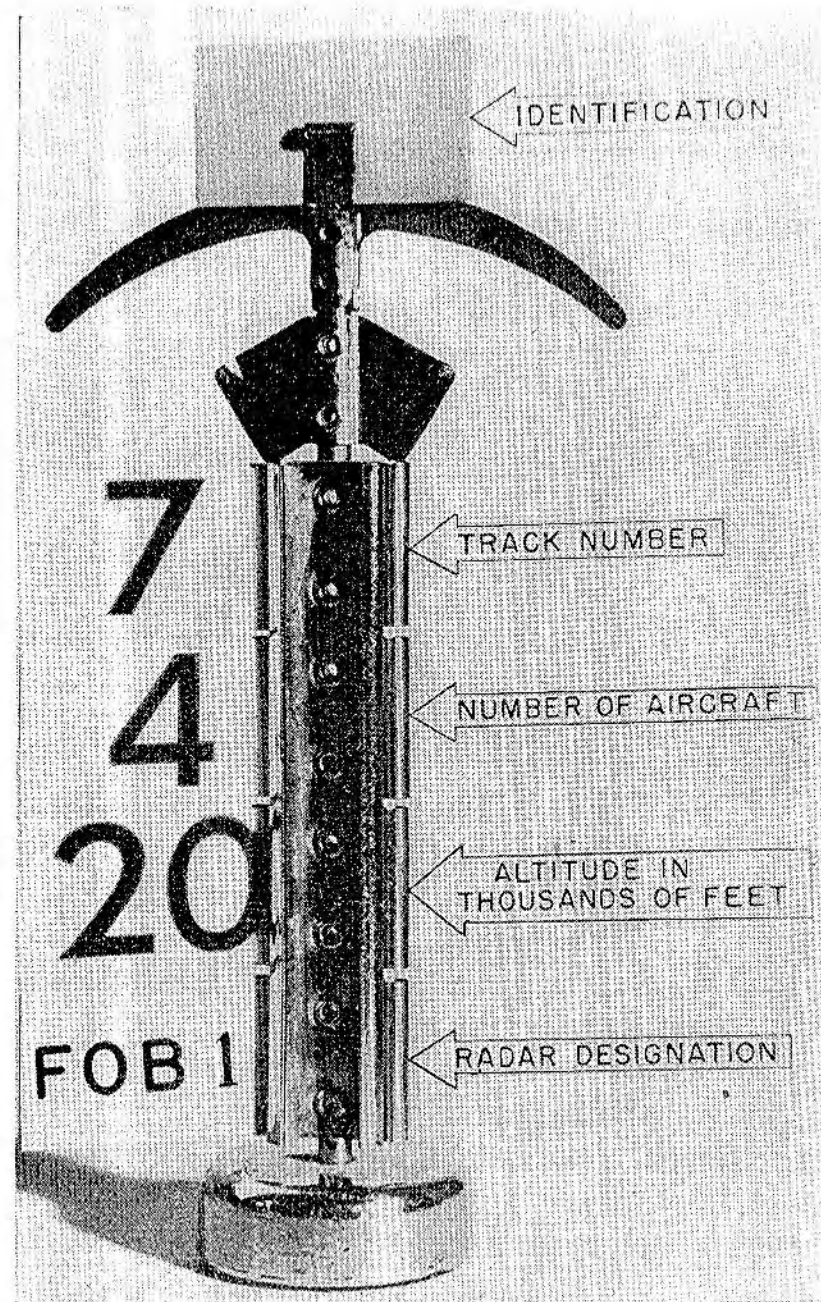


Figure 10. Example of a track stand.

CHAPTER 4

ANTIAIRCRAFT ARTILLERY INFORMATION SERVICE

Section I. GENERAL

27. Primary Considerations

a. The AAAIS is organized to provide warning to the elements of the defense by means of visual observers of the approach of low-altitude targets, and to provide information to the AAOC by means of surveillance radars of the approach of all other targets. It serves as a supplement to the early warning received from the Air Force. AAAIS provides a means for the contribution of information by all elements of the defense so that rapid evaluation and dissemination of pertinent intelligence may be made by the AAOC.

b. Under normal conditions, one AAAIS is established for each defended area; however, two or more defenses may integrate their AAAIS.

c. AAAIS will function in a manner which will permit the most economical employment of personnel and equipment. Thus, in a defense assured of adequate warning, it will not be necessary to have full-strength manning personnel always at their

equipment. This is one means of insuring a high order of efficiency in personnel employment.

28. Responsibility for Establishment

The AADC is responsible for the establishment and operation of the AAAIS. He normally delegates the duty of coordinating the AAAIS facilities to his S2. The S2 in turn will require the assistance of the communication officer and radar officer and must coordinate with the executive, the S3, and other staff members as necessary.

29. Sources of Information Organic to AAA

The AAAIS uses all available sources of information within the AA defense. There are two principal sources of information organic to the AAA—

a. Radar. TOE's authorize issuance of surveillance radars to AAA units. Radars of this type (AN/TPS-1D) have an average effective maximum range of 120 nautical miles. When necessary, the surveillance radars may be supplemented by the use of other AAA radars. Generally, such radars lack the range and pickup characteristics desirable for warning purposes; however, they are suitable for AAAIS to a limited degree. The acquisition radar of the antiaircraft fire control system AAFCS M33 has a search range of approximately 60 nautical miles and may be used in an AAAIS role.

b. Observation posts (OP's). Three-man ground AAA observation posts are established for the primary purpose of giving flash warning of low-flying aircraft to the AA defense. They will also be used to give warning where there are gaps in the

overall radar coverage. In the combat zone, they may report any hostile surface activity which they see. Light AAA gun crews derive the greatest benefits from the AAAIS OP's, as the OP flash warning alerts crews so that they can locate and track approaching targets in sufficient time to open fire at effective ranges. Other units in the defense receive this warning primarily for local defense.

Section II. PERSONNEL AND EQUIPMENT

30. Personnel

Personnel to operate the AAAIS are provided for on the TOE's of the AAA units. Radar operators, visual observers, and communications personnel are needed to operate the AAAIS.

31. Visual Observation

a. *Capabilities.* OP's are capable of—

- (1) Detecting low-flying aircraft.
- (2) Covering holes in radar net caused by terrain features.
- (3) Reporting information about items not of an aerial nature.

b. *Limitations.* OP's are limited by—

- (1) Human element (training and discipline).
- (2) Communications requirement.
- (3) Maximum of 10 miles between observers to insure visibility of all points between.
- (4) Supply, administration, and maintenance.
- (5) Local security.
- (6) Reduced effectiveness during hours of darkness.

32. Radar Equipment

a. *Source of AAAIS warning.* The principal source of AAAIS warning is the AN/TPS-1D surveillance radar.

(1) *Capabilities of the AN/TPS-1D.*

(a) Range:

Rated range----- 160 nautical miles
(184.25 statute miles).

Approximate effective range. 120 nautical miles.

Selective ranges for search. 20, 40, 80, and 160 nautical miles.

Accuracy----- ± 1 mile ($+3$ percent of range).

(b) Elevation----- Antenna is fixed and cannot be elevated.

(c) Azimuth:

Scanning----- Continuous 6,400-mil rotation in either direction at variable speeds up to 15 RPM.

Accuracy----- $+ 18$ mils.

(d) Beam width and height. 4° horizontal; 12° vertical (does not extend entirely above the horizontal).

(e) IFF equipment:

Type----- AN/TPX-19.

Presentation of data. Radar PPI scope.

(f) Portability----- Portable and air
transportable.

(2) *Limitations of the AN/TPS-1D.*

- (a) Limited ability to pick up low-flying targets.
- (b) Vulnerability to ground and air attack and electronic countermeasures (ECM).
- (c) Need for good surveillance radar site.
- (d) Inability to obtain altitude of a target.
- (e) Inability to detect close-in targets which have flown through the top of the beam.
- (f) Nulls in beam coverage which cause targets to fade as they progress from lobe to lobe.

b. *Acquisition Radar.* The acquisition radar of AAFCS M33 may be used as a supplementary radar for AAAIS purposes.

(1) *Capabilities of the acquisition radar of AAFCS M33.*

- (a) Search range----- 60 nautical miles.
- (b) Rate of antenna rotation----- 10, 20, or 30 rpm.
- (c) Vertical coverage:
 - Altitude----- 75,000 feet.
 - Angular height----- 0-1,250 mils (variable).
- (d) IFF----- AN/TPX-20.

(2) *Limitations of M33.*

- (a) Inability to pick up low-flying targets.
- (b) Vulnerability to ground and air attack and electronic countermeasures (ECM).
- (c) Need for a site which is satisfactory for both guns and radar.

CHAPTER 5

AAOC-AAAIS COMMUNICATIONS

Section I. GENERAL

33. Importance of Communications

Good communication is the most important factor in the operation of a successful AAOC-AAAIS system. Every person involved must be thoroughly grounded in communication operation and maintenance. This importance of training in the proper use of signal equipment in all echelons and for all personnel cannot be overemphasized. Thus the combat efficiency of an AAOC-AAAIS system can best be determined by a thorough test of its network. Since efficient communication is vital to combat effectiveness, it should be standard procedure for every commander to have alternate means of communication installed as quickly as possible in any tactical situation. In addition to nets required for the operation of the AAOC-AAAIS system, this manual will discuss other nets which will be found in a normal AAA defense setup.

34. Primary Considerations

Antiaircraft artillery communications include all the means employed to transmit information, intelligence, and commands between AAA units, and the means to establish liaison with other arms and serv-

ices. The basic means of communication available to all AAA units are radio, wire, and messenger. Equipment available and the tactical situation will govern the type of communication to be used. Thus, in rapidly moving situations and in amphibious operations, radio will be the primary means of communication. However, wire is generally the most dependable form of communication, and every effort must be made to use it to the fullest extent feasible when existing conditions favor its employment. In static situations as in the zone of interior, commercial wire facilities backed up by radio will generally be utilized. To insure continuity of communication, alternate means should be established and immediately available for use. Communication systems should be as elaborate and complete as time, equipment, and the tactical situation will permit. In combat, the minimum requirements for accomplishing the mission govern the extent of the communication system.

35. Factors Influencing Establishment

In any situation, a selection of the means of signal communication to be employed and the extent to which the communication system will be installed depends upon the following factors:

- a. Facilities available.
- b. Frequency of movement.
- c. Dispersion of units.
- d. Terrain and atmospheric conditions.
- e. Security restrictions.

36. Coordination of Activities

The S3 of each organization should coordinate closely with the communication officer during train-

ng. The AADC's S3 and communication officer must work together during planning, reconnaissance, and establishment of the AA defense.

37. Communication Nets

In all AAA defenses, communication nets will be installed as required. A general plan may be seen in figure 1. The AAA communication nets include the following:

a. *Air Force Liaison Net.* This is a two-way wire or radio net (or both) which connects the AA liaison officer in the Air Force agency with the AADC's representative (AAOO) in the AAOC. This net is usually established by mutual agreement or by the senior joint commander.

b. *Early Warning Net.* This net is a one-way wire or radio net (or both) from the AA teller in the Air Force agency to the early warning plotter in the AAOC. In the zone of interior and communications zone, this is usually established by the Air Force and employs Air Force or commercial equipment; in the field army, the primary AAOC in the area usually establishes this net.

c. *OP Net.* This is the net (or nets) established for the transmission of information from AAA visual observation posts. It may be a radio net, a wire net, or both, although wire is seldom used. This is a two-way net from AAOC to all OP's, but a one-way net from OP's to all other defense elements.

d. *Radar Reporting Net.* This is the net (or nets) over which radars operating in a surveillance role within the AA defense transmit target data to the AAOC. This net may be a radio net, a wire net, or both.

e. Intelligence Net. This is the net (or nets) over which the AAOC disseminates intelligence. This is its sole use. Intelligence from the Air Force is disseminated as necessary along with intelligence emanating from AAA sources. It may be a radio net, a wire net, or both, and is a one-way net.

f. Operational Control Net. This is the net over which the commander or his representative exercises operational control of all units in the defense. This may be a radio net, a wire net, or both, and is a two-way net. When the AAOC is controlling a large number of units, it may be necessary to establish an operational control net system, consisting of a number of nets, because of the large volume of operational traffic and the technical limitations of communication equipment.

g. Command Net. This net is normally established from the administrative headquarters of the AA commander and not from the AAOC. However, the AAOC is normally adjacent to or a part of the AADO's command post. The net is available to the AAOC, and is therefore included in this discussion. This is the net (or nets) over which the commander exercises authority over assigned and/or attached units. All essential elements of command for which other nets are not established, including administration, are transmitted over this net. It may be either a radio net, a wire net, or both. This is a two-way net and extends through normal command channels.

h. Other Liaison Nets. Liaison nets with agencies other than the Air Force will be established as may be necessary. These nets may be radio nets, wire nets, or both.

Section II. RADIO COMMUNICATIONS

38. Nets

In order that radio communication may follow the proper channels of tactical command, the radio station of a superior unit and the radio stations of its subordinate units are grouped into nets. A radio net is two or more stations operating on the same frequency for the purpose of exchanging messages. The composition of each net depends upon the tactical grouping of units within a command.

a. Net Control Station (NCS). The grouping of radio stations into nets requires a definite procedure to adjust equipment, to control transmission, and to clear messages. In order to have centralized control and to maintain the strict discipline necessary in an efficient radio net, a net control station is required. The station of the superior unit is the net control station unless another station is so designated. The NCS has full authority in matters of technical control but none over internal organization or tactical employment of any station. Other stations in the net are known as subordinate or secondary stations.

b. Call Signs. Every radio net is assigned a frequency on which it must operate, and every station is assigned a call sign by which it is identified. A call sign, termed the net call, also is used to designate the entire net. This net call is used by any station to call all stations in a radio net. Call signs are composed of three or four characters, such as AB1 as a station call sign, and ABC as a net call sign. Call words, often used to identify radiotelephone stations, consist of a word, or a word and a numeral, such as BOSTON or BATO 6. Call signs and frequencies

for each station are published in the signal operations instructions (SOI) and are changed at frequent intervals to insure security.

39. Radiotelephone Procedure

Correct radiotelephone procedure under any operating condition is characterized by brevity, uniformity, and simplicity. Radiotelephone procedure is covered in ACP 125 (A). All officers and enlisted men involved in the AAOC-AAAIS system must be thoroughly indoctrinated in radiotelephone procedure and must comply with the instructions contained in ACP-125 (A).

40. Security

a. Transmission security is essential. Unnecessary and improper transmissions must be avoided to prevent the enemy from obtaining information from our radio activity. Such information, when pieced together, may reveal the tactical disposition and strength or movement of our forces.

b. Radio silence is a period during which all or certain radio equipment capable of electromagnetic radiation is kept inoperative. Listening silence is a period of time specified by a commander during which the transmitters of all radio sets used for signal communication within the command will be completely shut down and will not be operated except during emergencies specifically described in orders. All receivers will remain in operation on net frequencies unless special orders are issued to the contrary.

41. Radio Supplementing Wire

In radio nets which supplement wire communication, operators listen on the assigned frequency un-

less otherwise instructed. Transmission of messages by radio is permissible to supplement wire communication, and if the wire line becomes disrupted, the radio net takes over full operation. In radio nets not supplemented by wire, operation is normally continuous unless otherwise prescribed.

42. Supervision

A high state of training of all personnel using radio sets and constant supervision by the commander and his staff are required. Principal staff responsibility for this supervision rests with the communication officer, but all officers should be alert for breaches in communication discipline.

Section III. WIRE COMMUNICATIONS

43. General

Radio will be the means of communication most normally employed while on the march and in the early stages of an operation. However, wire should be installed to parallel all radio nets (except OP nets) as soon as practicable. Alternate wire lines should be installed (over different routes) to insure continuity of communication. Wire lines should be laid before moving into a position. The wire laying methods indicated in FM 24-20 should be followed. If enemy use of atomic weapons is a possibility, efforts should be made to lay field wire and cable on the ground or underground, because of the greater vulnerability of overhead wire to atomic blast. Commercial facilities may and should be used where practicable, although care must be taken to insure that the severing of commercial lines during an attack will not nullify the AA defense.

44. Responsibility for Wire Laying

The normal rules of responsibility for establishment of communications will apply. Superior headquarters are responsible for the establishment of wire communication with subordinate units, supporting headquarters are responsible for the establishment of wire communications with supported headquarters, and the responsibility for the establishment of lateral lines will be as directed by higher headquarters or as directed by SOP.

a. Responsibilities Within Units. It will be the responsibility of the battalion commander to extend all wire lines to the batteries, and it will be the responsibility of the batteries to extend these lines to the platoons or fire units, as may be desired. These lines will normally be attached to terminal strips near each headquarters to facilitate connections. They will not be connected at unit switchboards. Wires terminating at local phones will be tapped off these terminal strips to permit monitoring at each intermediate headquarters (group, battalion, and battery).

b. Command Lines. Command lines are laid according to the normal rules for wire laying. These lines are interconnected at unit switchboards. Installation of locals at each CP will conform to the commander's desires and the number of phones available.

c. Radar Reporting Lines. Responsibility for the installation of radar reporting lines from the AAOC to all surveillance radars rests with the AA defense commander.

d. Intelligence and Operational Control Lines. Responsibility for the installation of the intelligence and operational control lines from the AAOC to the battalions in the defense rests with the AADC.

e. OP Nets. In most situations it is impractical to use wire lines in the OP nets because of the complexity of and the number of outlets involved in this net.

f. Liaison Lines. Responsibility for the installation of liaison lines must be determined by mutual agreement between AAA and Air Force or other units, or as directed by the next senior commander.

45. Method of Wire Installation.

For methods of wire installation see FM 24-20.

CHAPTER 6

AAOC-AAAIS EMPLOYMENT AND OPERATION

Section I. GENERAL

46. Primary Considerations

a. Specific techniques of operation of the AAOC-AAAIS system will vary with the situation. The methods discussed in this manual should serve as a guide. They are applicable to AA operations in both the theater and the zone of interior, although the problems presented and methods of operation may differ widely between the two. Current Allied Communications Publications (ACP) and SOI's must be consulted to obtain proper procedures and code words. Coordination with nearby Army, Air Force, Navy, Marine, and civilian air defense agencies is imperative and may require certain modifications in normal procedures. All references to plotting equipment are applicable to both vertical and horizontal plotting methods unless otherwise noted.

b. All personnel operating in the AAOC-AAAIS system must be thoroughly familiar with the position referencing system used and capable of reading grid coordinates quickly and accurately. The world geographic reference system (Georef) is the established grid for air defense operations on the North

American continent. In theaters of operation either the Military Grid Reference System or Georef may be prescribed for air defense operations by the theater commander.

c. In AAA, Georef grid coordinates are read in 2 letters (second 2 of 4 basic letters) and 4 numbers. The first 2 letters are not used. This is done to simplify the reference for voice transmissions, in that the second 2 letters identifying a 1° quadrangle will not usually appear more than once in a given area of interest. Exceptions will be found in limited operation theaters. Figures 6, 8, 12, and 15 illustrate the use of Georef on operations boards, situation boards, and PPI scopes. For further details on Georef, see TM 44-225.

d. The Military Grid Reference System (MGRS) is designed for use with maps showing the Universal Transverse Mercator (UTM) and the Universal Polar Stereographic (UPS) grids. In AAA, UTM (UPS) grid coordinates are read in 2 letters (the 100,000-meter square) and 4 numbers. The grid *zone* designation (first number and letter) is not normally used in that the letters identifying the 100,000-meter square do not usually appear more than once within any 18° by 24° area. If a spheroid junction or a grid junction falls within the area of interest, however, the grid zone designation must be included. The use of MGRS on a situation board and a PPI scope are shown in figures 13 and 16. TM 5-241 explains the MGRS in detail.

47. Staff Coordination

The establishment of the AAOC-AAAIS system requires a high degree of staff coordination. The

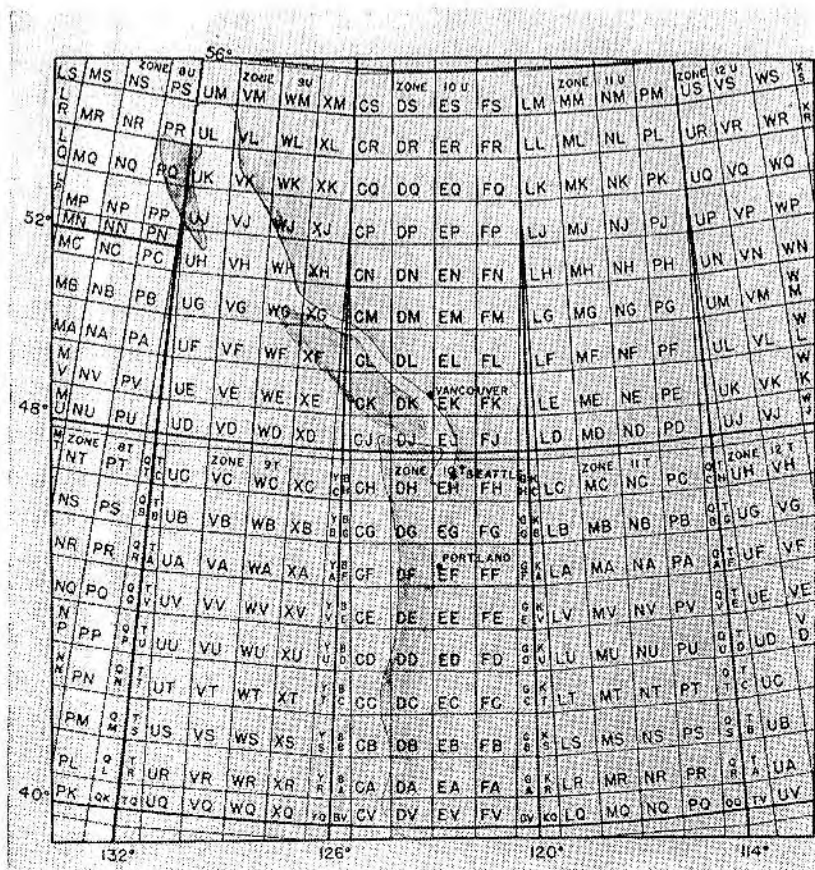


Figure 13. Situation board, UTM grid.

executive, S2, S3, radar officer, communications officer, and AAAOD commander (if present) all are involved, and the overlap of staff responsibility is extensive.

48. Flexibility

Considerations for planning, organizing, establishing, operating, and maintaining the AAOC are many and varied. Each situation will present new and different problems or new solutions for old problems.

Imagination, ingenuity, and flexibility are essential in AAOC staff work.

49. Location of AAOC

a. *General.* Communications is the greatest single factor involved in determining the site for the AAOC. To facilitate the laying of wire and to insure the best possible radio contact with elements of the defense, the AAOC should be centrally located. The center of any area involving an AA defense, however, will usually be near the center of the vulnerable area as well. Since the vulnerable area is the target for the enemy, the AAOC is not usually placed there. A better place is near the edge of the vulnerable area. Occasionally, however, because of the size or nature of the vulnerable area, the AAOC will be within its limits. The AAOC must always be as inconspicuous as possible. Full advantage should be taken of existing buildings, cover, and concealment.

b. *Protection Against Atomic Attack.* The AAOC should be located to minimize the effects of atomic attack. If possible, the site should be in defilade from the potential target area. Hazards from fire, falling buildings, and flying debris should be considered. Alternate AAOC's should be so located that a single atomic weapon cannot destroy both.

c. *AAOC and AADC's Headquarters.* The AAOC must be readily accessible to the AADC and his staff. Since it is his battle or tactical CP, it is the most important part of his headquarters during time of attack or threatened attack. Siting of the AAOC is the most important consideration in choosing the AADC's headquarters; however, a good site for the AAOC will have most of the requi-

sites of a good headquarters site and no conflict should arise. Quarters, mess, sanitary, and supply facilities for AAOC personnel are readily available if the AAOC is adjacent to the AADC's administrative headquarters area.

d. Local Security. Protection of the AAOC must always be considered when choosing its site. Maximum use of passive measures will be made. Perimeter defense will be furnished as required by the situation. It must always be remembered that the AAOC, since it is both a CP and a communications center, is a prime target for guerilla- and infiltration-type attacks.

50. Exclusion of Unauthorized Personnel

a. Classification Security. In addition to protection from attack, classification security is important. Operation within the AAOC should be classified. Unauthorized personnel, both military and civilian, should be excluded. When danger from ground attack is remote, a security guard is still required. Trespassing, prowling, and photography should be forbidden.

b. Efficiency. The exclusion of unauthorized personnel from the AAOC is dictated not only for security reasons but also in the interests of efficient operation. No one except manning personnel should be admitted to the AAOC without the express approval of the AADC or the AAOC on duty. The visits of outside personnel should be kept to a minimum. Efficiency in the AAOC will decline measurably as a result of having surplus personnel within it. Visits of all AA defense personnel to the AAOC are highly recommended as a training feature,

but these visits should be carefully coordinated so as to disrupt AAOC operation to the least possible degree.

51. Personnel

a. Staff. Staff action for the organization, establishment, and operation of an AAOC requires the executive officer to make full use of all available staff officers. The S2 will offer usual intelligence reports that may affect establishment and operation of the AAOC and will know all details pertaining to the AAAIS system, which is vital to the operation of the AAOC. The S3 plans the AA defense of the vulnerable area and this information is important to planning and operating the AAOC. The S4 will obtain equipment required by the special situation. The communication officer will plan line routes, know frequencies, and advise the executive officer on communications in general. The radar officer will inform the executive, perhaps through the S2, of all details pertaining to radar operation which may affect AAOC operation.

b. AAAOD. Brigades and groups which are the senior headquarters in an AA defense normally will have an AAAOD attached to furnish the personnel and equipment needed for the establishment and operation of the AAOC. The AAAOD commander should be made a special staff officer by published order upon reporting to the parent unit. As such, he, his staff, and certain enlisted personnel will act as an AAOC special staff section for the executive officer. When no AAAOD is attached, personnel for this function must be obtained by coordinated staff action within the headquarters.

FOR OFFICIAL USE ONLY

65

c. Manning Personnel. The AAOC should be manned at all times. Duty rosters will be planned, coordinated, and published as appropriate.

- (1) An AAOO (par. 25) will be on duty in the AAOC at all times. A roster of all qualified members of the AADC's staff should be published. This roster will include AAAOD officers, when appropriate, but not to the exclusion of other staff officers. Assistant AAOO's may be needed during active periods. Measures must be taken to insure their availability.
- (2) Enlisted personnel, whether AAAOD members or a detail from the AADC's headquarters personnel, will be assigned on a roster basis which takes into consideration other duties, housekeeping, administration, training, and attrition. During periods of relative inactivity, skeleton crews may be used, but additional personnel to man the AAOC completely must be immediately available.

52. Alternate and Subordinate AAOC's

a. Alternate AAOC's. Alternate AAOC's (par. 21) must be established. There is no limit to the number of AAOC's which may be designated as alternates. In order to function properly as an alternate, an AAOC must have sufficient personnel and equipment to relieve the primary AAOC completely and efficiently. The first requirement for any information AAOC to become an alternate is communications. All nets required for the operation of the AA defense

must be available within an alternate AAOC. These nets should be laid over separate routes from those used for communication to the primary AAOC in order better to protect their operability in case of failure of the primary AAOC. Frequent checks of these communications must be made. When more than one alternate AAOC is established, SOP will prescribe the order of priority for relief of the primary AAOC. Frequent training missions, both scheduled and nonscheduled, are imperative to maintain a high state of efficiency of alternate AAOC's.

b. Subordinate AAOC's. Subordinate AAOC's (par. 21) are established when the particular situation requires their use. Subordinate AAOC's are normally established when two or more defended areas are under one AADC. In the zone of interior, where a single antiaircraft defense may be substantially larger than in theaters, sector control (fig. 14) may be initiated. Under this system, an antiaircraft defense is divided geographically into several sectors, each with a subordinate AAOC, and with a primary AAOC for the entire defense. The AADC may, as the situation requires, exercise tactical control of all units of the antiaircraft defense from the primary AAOC, or he may delegate this control to the subordinate AAOC's in each sector. Two sectors may share an AAOC when conditions permit. One subordinate AAOC must be designated as the alternate primary AAOC and must be capable of assuming the functions of the primary AAOC. An AAAOD is generally available to man the primary AAOC, but the subordinate AAOC's must make use of personnel organic to the units they control.

SECTORS OF FIRE

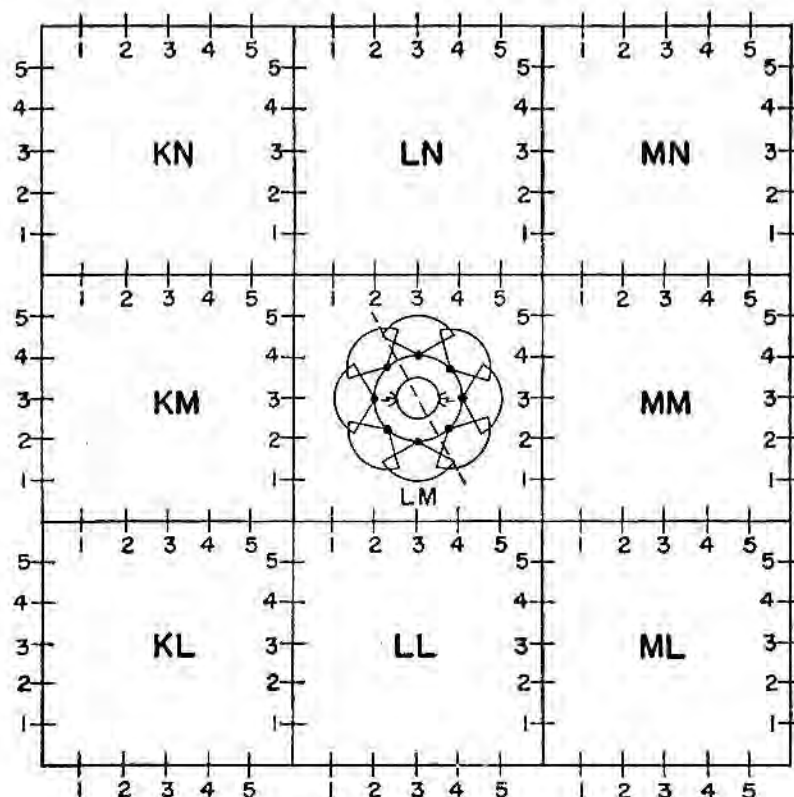


Figure 14. Example of sectors of fire board.

Section II. OPERATION OF AAOC LIAISON WITH AIR FORCE

53. GENERAL

Since AAA obtains early warning from the Air Force, it is imperative that a 24-hour watch be maintained in the appropriate Air Force control and warning agency (ch. 2). An AA liaison officer (AALO), with an adequate staff, forwards air surveillance information, control data, and intelligence to the AAOC.

54. Air Force Air Defense Levels

a. Air Surveillance. Air surveillance by the Air Force provides a current and accurate visual presentation of the air situation from which an Air Force commander may evaluate the situation and initiate appropriate air defense action. Operationally, the organization of the air surveillance sections within an air defense system is pyramidal in form. Each unit is charged not only with the accumulation and display of information pertinent to the air situation within its area of responsibility, but also with the rapid and accurate transmittal of this information to a higher echelon, where it is consolidated into broader integrated displays. It will also be transmitted to adjacent air defense agencies, who may find it useful.

b. Dissemination of Information. A direction center may receive current air surveillance information from its own electronic search and detection equipment, from other land-based warning agencies (surveillance station, AAOC), shipborne (picket ship) and airborne early warning (AEW) radars, or other military establishments, and from ground observer corps filter centers. The control center, in turn, will receive and display air surveillance information from each of the direction centers under its jurisdiction, thereby providing a command post wherein the air division (defense) commander and his staff are kept informed of the situation within the air division's area of responsibility. Certain elements of this presentation are forwarded from each air division (defense) control center to the air defense force combat operations center (COC) for use by the air

defense commander, and thence to higher echelons of command. Thus similar and almost simultaneous displays of the air defense situation are presented at each level of command, providing the information upon which appropriate decisions are made and forces for air defense are committed.

55. Antiaircraft Liaison Team

An AA liaison team to the Air Force should consist of an AALO and enough officers and enlisted men to provide for 24-hour manning. One officer should always be on duty in the Air Force agency, and he must have tellers and recorders as necessary. One teller will always be needed and, unless there is much activity, the AALO and his teller should be able to maintain the AA liaison journal.

56. Antiaircraft Liaison Officer (AALO)

a. Responsibilities. The AALO is the AADC's representative to the air defense commander. He has the following responsibilities:

- (1) Represents the AADC on all matters pertaining to the employment of AAA in air defense including SAM guided missiles.
- (2) Takes part in planning conferences with the air defense commander and his staff.
- (3) Informs the air defense commander of the current status of the antiaircraft defense.
- (4) Informs the AADC of the current status of other elements of the air defense system.
- (5) Passes Air Force air surveillance information and intelligence to his AAOC.
- (6) Receives antiaircraft air surveillance information and intelligence from his AAOC and

passes appropriate items on to the Air Force.

- (7) Maintains a complete journal of AA activities at the Air Force agency.
- (8) Administers, controls, and trains the AA liaison team.
- (9) Informs the senior director and requests identification of all plots originating in the AAOC and not displayed in the Air Force agency.

b. Functioning. The AALO, or an assistant AALO, will always be on duty in the Air Force agency. His position will be such as to allow unobstructed view of all screens, boards, etc., on which air defense data are displayed. He must have direct communication with the senior director (controller), the movements and identification officer, the AA teller, and his own AAOC.

57. Antiaircraft Teller

The AA teller in the Air Force agency is positioned so that he has an unobstructed view of the various plotting boards and data boards. The AA teller, acting within local SOP, tells all hostile plots and appropriate friendly plots directly to the early warning plotter in the AAOC. The following examples of sequence may be utilized (code designations may be used where appropriate, and unknown items will be omitted):

a. Initial Plot.

- (1) Initial plot.
- (2) Identification (if available at this time).
- (3) Grid position.

- (4) Time in minutes after the hour.

Example (Georef): "Initial plot hostile at Nan Charlie two zero five one, time two six."

Example (MGRS): "Initial plot hostile at Ten Tare Able How five three four five, time one eight."

b. Subsequent Plots.

Example (MGRS)

- | | |
|---|---------------------------------------|
| (1) Identification..... | "Unknown," |
| (2) Grid position..... | "At Baker How two
five five four," |
| (3) Track designator ¹ (e below). | "Track Baker two
nine Baker," |
| (4) Number of airborne objects. ¹ | "Ten aircraft," |
| (5) Speed in knots ¹ ---- | "Speed one five zero," |
| (6) Altitude in thousands of feet. ¹ | "Altitude two six," |
| (7) Remarks (only when required). ¹ | "Orbiting." |

c. Contact Lost. If an established track is displayed on the air surveillance board as *contact lost*, the teller will report the track in sequence indicated above, reporting *contact lost* under remarks. *Example*: "Unknown at Baker George two zero five one, track Baker two nine Baker, contact lost."

d. Mass Tracks. Mass tracks will be told by the teller using the following sequence:

(1) *Multiple mass track:*

- (a) Identification.
- (b) Multiple mass track.
- (c) Grid position of lead element.

¹ These items will be told on the first subsequent plot and when changes in this information occur.

- (d) Track designator.
- (e) Width of track in miles.²
- (f) Length of track in miles.²
- (g) Number of aircraft.²
- (h) Speed in knots.²
- (i) Altitude in thousands of feet.²

(2) *Stream mass tracks:*

- (a) Identification.
- (b) Stream mass track.
- (c) Grid position of lead element.
- (d) Track designator.
- (e) Length of stream in miles.²
- (f) Number of aircraft.²
- (g) Speed in knots.²
- (h) Altitude in thousands of feet.²

e. Track Designator. A track designator is given to each track detected by a direction center. The track designator includes, in addition to the track number, an alphabetical prefix to identify the subsector in which the track originates, and an alphabetical suffix to indicate the station currently observing the track. The numerical portion of a track designator will be a number between 1 and 99, inclusive. When using vertical boards, the data displayed by the track designator may be placed near the plot, or only the track number and identification may be placed on the plotting surface and the height-tote screen used for presenting the rest of the information. On horizontal boards track stands may be used to display all of the data.

² These items will be told on the first plot and when changes in this information occurs.

Section III. AAAIS RADARS

58. Siting

a. General. The siting of all surveillance radars (par. 32) present in the defense must be coordinated by the AADC. When planning the AAAIS, the S2 and radar officer on the staff of the AADC will make a map reconnaissance for sites. They must take into consideration the line of sight characteristics of radar, the number of radars available within the defense, all-around coverage, backup, the character of the reflecting surface, and accessibility for the equipment. Ground reconnaissance by the AAA unit commander is important, and during this phase each proposed radar site should be occupied and clutter and coverage diagrams prepared and evaluated. New sites will then be chosen as dictated by the situation. Time does not always permit this procedure. In these cases evaluation of the position by use of an optical sighting device is advisable. If there is sufficient planning time, but no opportunity to make a ground reconnaissance, a thorough sampling of the terrain by use of profiles is recommended. While 360° coverage from each site is desirable, placement of surveillance radars must be made with respect to the best interests of the defense as a whole.

b. Communications. Communications must always be considered in choosing surveillance radar sites. The radar reporting net is a direct line from the radar to a plotter at the AAOC. With regularly issued field wire, a surveillance radar normally must be within 12 to 20 miles of the AAOC. Radio is also provided for the radar reporting net, and voice radio range from the AAOC is therefore another

factor to be considered when choosing AAAIS radar sites. When special communications equipment is furnished which is superior to that on TOE, radars may be sited farther from the AAOC as long as alternate means of communication are provided.

c. Accessibility. Accessibility must be considered when choosing sites for AAAIS radars. In fast-moving situations where time is limited, accessibility must be quick and certain. On the other hand, in static situations where quasi-permanent defenses are being established, accessibility may be subordinated if a sufficiently superior site will result.

d. Supply, Maintenance, and Administration. Supply, maintenance, and administration must be considerations in the choice of proper sites for AAAIS radars.

e. Grouping of Radars With CP's. Whenever possible, a unit possessing a radar set on TOE should choose its CP location so as to include a radar site. If this is done, the close coordination necessary between the radar and the CP is more easily obtained. Further, the defense of the radar (par. 62) is greatly facilitated. Every effort should be made by the AADC to allow AAAIS radars to remain at their proper CP's. However, it is recommended that two AAAIS radars occupy a single site when possible. If all radar sites throughout the defense have been properly chosen and coordinated so as to afford 360° coverage, two radars per site would insure 24-hour surveillance. Normally, two men are required to operate the radar and to transmit data to the AAOC. With two radar crews available at each site, manpower should be sufficient to take care

of operation, maintenance, training, rest and recreation, administration, and attrition. While integrity of command is important, subordinate commanders must recognize that the mission of the AADC is of prime importance.

f. Continual Evaluation. Even after radar sites for a defense have been occupied, continual evaluation of the defense radar system is imperative. Clutter and coverage diagrams, while useful, do not necessarily indicate how a particular radar will react from a particular site toward airborne targets. Every effort should be made to have controlled aircraft missions flown in order to obtain more accurate evaluation of the AAAIS radar net. Evaluation of such missions will frequently show the need for resiting certain radars. Calibration flights may be requested through appropriate channels.

59. Acquisition Radars

When surveillance radars and crews provided by TOE are insufficient for providing 24-hour, 360° AAAIS surveillance, other local warning means must be found. The principal additional source of warning available to medium and heavy gun units and guided missile units is the acquisition radar of the fire control system. When acquisition radar equipment is used to complement or supplement normal AAAIS radar, it must always be remembered that this equipment has a primary mission of providing target acquisition for its parent unit. These radar sites, accordingly, must be chosen with the primary mission as a first consideration and with the mission of AAAIS as a secondary consideration. After an evaluation has been made of the acquisition radar

sites, the normal AAAIS radar sites should be picked out in order to insure that the best possible 24-hour, 360° coverage is obtained and maintained.

60. Coordinate Conversion

Since the radar furnishes target location in polar coordinates, it is necessary to convert to grid coordinates of the grid system in use by the defense. The following methods may be employed:

a. Conversion Board. The conversion board is a small scale representation of the area of coverage of the radar. Superimposed on the conversion board are grid coordinates of the grid system used by the defense and a system for reading polar coordinates. By determining the target location in polar coordinates from the PPI scope, and plotting this information on the conversion board, grid coordinates are determined and transmitted to the AAOC.

b. Gridding of PPI Scopes.

- (1) Available for issue to units equipped with the AN/TPS-1D radar is the Georef Grid Overlay Kit, MK164()/GP. By using this kit, grid coordinates may be reported directly from the radar scope to the AAOC. Units operating in a defense which uses the MGRS system rather than Georef, or which are equipped with another type radar, may construct a gridded template for the PPI scope in the following manner:
 - (a) Determine the scale from the relationship between the size of the scope and the range of the sweep of the scope. For example, the scope on the AAFCS M33 radar is 10 inches in diameter and the

scale used with the 120,000-yard sweep is 1 inch to 24,000 yards.

- (b) Draw the grid system used by the defense to the proper scale on acetate or other transparent material. If photographic reproduction is available the sketch may be prepared on plain paper and then photographed. By reversing the negative, a good template may be produced.
 - (c) Determine the grid coordinates of the radar's position and mark this position on the template.
 - (d) Describe a circle the radius of which is one-half of the diameter of the scope and the center of which is the radar position.
 - (e) Label the blocks of the grid with the proper letters and numbers of the area of operation of the radar.
 - (f) Cut out the circle described, allowing enough excess to hold the template in place, and fasten it behind the amber glass sheet that covers the PPI tube of the radar, taking care that the grid is properly oriented.
- (2) Figure 15 shows a 7-inch PPI scope with a Georef grid template and figure 16 shows the same scope with a UTM grid template. For the technical construction of the various grid systems, see TM 44-225. To convert degrees of longitude and latitude to yards for different areas of the world, see TM 5-236.

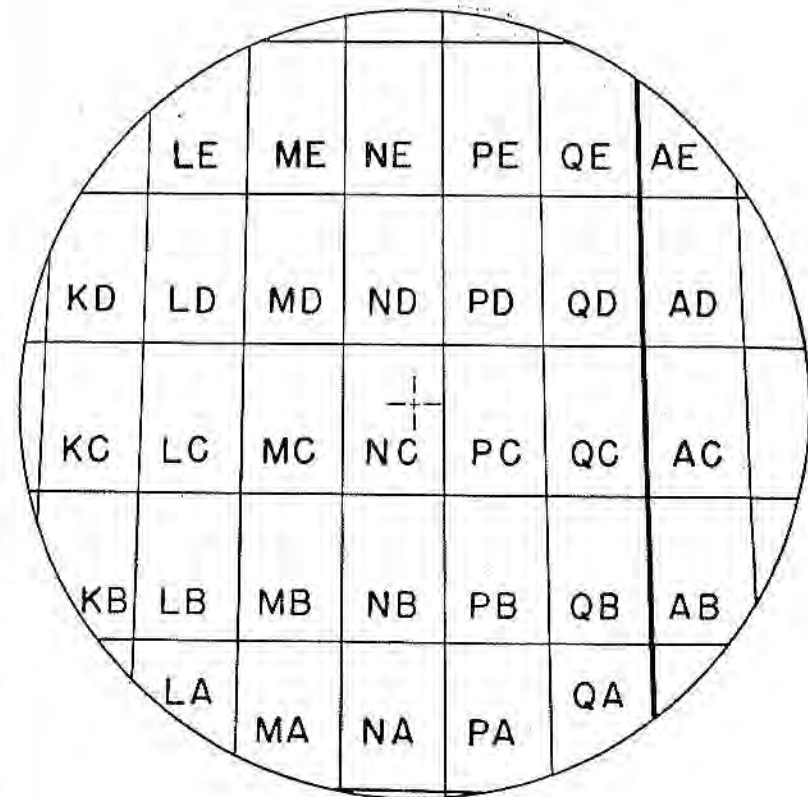


Figure 15. PPI scope template, Georef grid.

61. Orientation and Calibration

The radar must be oriented as prescribed within the defense area. Moreover, if a gridded template or overlay is used on the PPI scope the range sweep must be calibrated to correspond to the scale of the grid overlay.

62. Defense of Radars

Radars are choice targets for infiltrators, guerillas, and low-flying aircraft because of their importance, susceptibility to disablement, lack of maneuver-

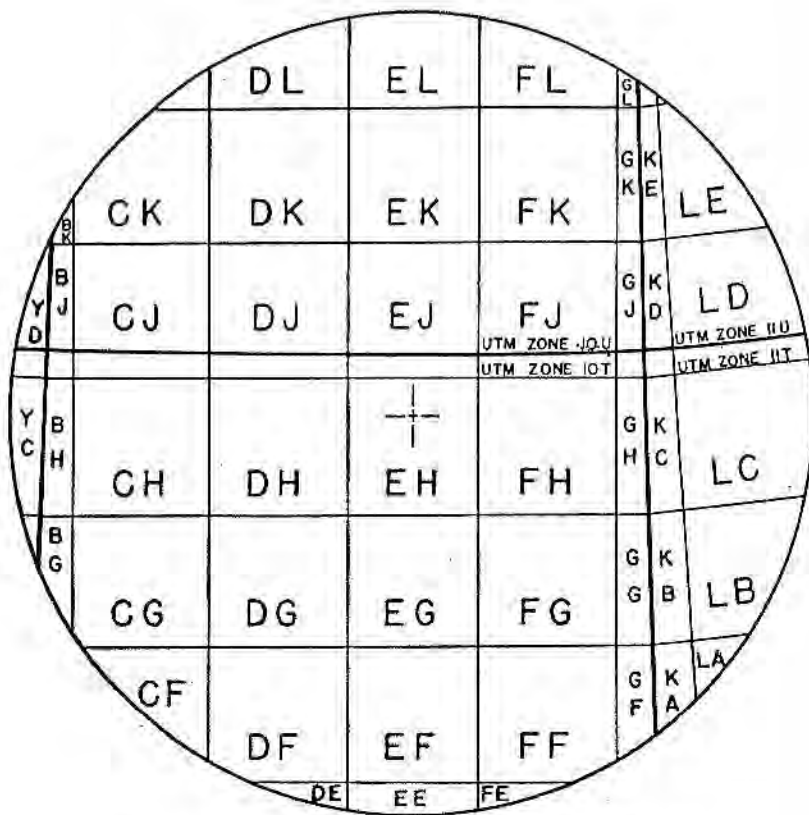


Figure 16. PPI scope template, UTM grid.

ability, high silhouette, and small crews. The TOE does not provide sufficient personnel or equipment for adequate protection of the surveillance radar if it is located outside the unit area. Digging in and camouflage will be utilized to the full extent permitted by the situation and operation of the radar. When infiltrators and guerillas are a threat, radars should be emplaced within an existing perimeter defense. As protection against air attack, it is advisable that, whenever possible, radar sites be chosen that are within covering distance of some of the light antiair-

craft weapons involved in the defense of the vulnerable area, so as to receive incidental protection from such weapons.

63. Primary Sectors

Based on evaluation of the radar sites, primary sectors for reporting will normally be assigned each site. Telling will be done in a clockwise manner when multiple targets are detected. All targets appearing on the PPI scope which are not in the primary sector will be reported until the order to cease telling is received from the AAOC. Telling of plots from the radar will be over the radar reporting net.

64. Duties of Radar Teller

The radar teller is positioned before the PPI scope of an AAAIS radar and wears a head and chest set connecting him to a radar plotter in the AAOC. He will—

- Receive all information and special instructions pertaining to his site from the chief radar operator and the operator who precedes him on duty.
- Familiarize himself with the scope picture and current air situation prior to relieving the operator on duty.
- Make necessary optimum adjustments to the radar.
- Insure that the radar is oriented as prescribed and that the PPI range sweep corresponds to the scale of the grid overlay.
- Report each plot at least once each minute on each established track in his primary sector.

f. Be constantly alert for new targets that may appear.

g. If possible, estimate the number of airborne objects in each track as it is established.

h. Follow SOP as pertains to use of IFF.

i. Cease telling on targets as directed.

j. Report targets in the following sequence (code designation may be used where appropriate and unknown items will be omitted):

<i>Initial Plot</i>	<i>Example</i>
(1) Code name of radar-----	"Dot 1,"
(2) Initial plot-----	"Initial,"
(3) Grid position-----	"NC4545" (Georef).
(4) Estimated number of airborne objects. ¹	"Few,"
(5) Identification by IFF response-----	"IFF incorrect,"
(6) Altitude in thousands of feet ¹ -----	"Two five,"
(7) Closing-----	"Out."

<i>Subsequent plots ²</i>	<i>Example</i>
(1) Code name of radar-----	"Dot 1,"
(2) Grid position-----	"NC4646" (Georef),
(3) Closing-----	"Out."

Section IV. AAAIS OBSERVATION POSTS

65. General

While the primary purpose of the AAAIS OP's is to detect and report low-flying aircraft, the use of OP's in filling holes in the existing radar net is important. AAAIS OP sites for an AA defense must be coordinated by the AADC's headquarters. When planning the AAAIS, the S2 will make a map reconnaissance for sites. Ground reconnaissance

¹ Included if available.

² Elements in the initial message which change will be announced as part of the subsequent messages.

will be made by the unit from which the OP team is drawn. When ground reconnaissance is not possible prior to occupation of position, a thorough terrain evaluation should be made through use of profiles.

66. Siting

a. *General.* AAAIS OP sites must provide 360° coverage with emphasis on the detection of minimum altitude and low-flying aircraft. OP's cannot be expected to see more than 3 to 5 miles under optimum conditions. For planning purposes, 10 miles is the maximum permissible distance between OP's. Terrain, weather conditions, darkness, training, discipline, and morale all affect the efficiency of OP operation. Taking into consideration all other factors, OP's normally are placed around the vulnerable area, within communication distance of each light AA fire unit (or, in large defenses, each OP must be within communication distance of each fire unit that is required to hear reports from that particular OP), and in position to visually observe aircraft which fly between adjacent OP's.

b. *Communication.* Communication is an important consideration in the siting of AAAIS OP's. Radio, available on TOE, is the normal means of communication. The rated voice range of the radio must be a primary consideration. While rated voice ranges are published for all military radio sets, it must be remembered that state of training of personnel, atmospheric conditions, terrain, and electronic interference greatly affect attainable ranges for any particular time or place.

c. *Radar Gaps.* When an evaluation of radar sites has been accomplished, it may be discovered that

certain areas do not have adequate radar coverage. AAAIS OP's should always be sited to afford the best possible coverage in these areas. Since normal siting of OP's allows only a limited warning time because of communication limitations, every effort should be made to extend this warning time when an OP is used to fill a hole in the radar screen. The two most frequent ways of doing this are by the use of relay stations and the substitution of communication equipment that is superior to that available on TOE.

d. Accessibility. Accessibility to the OP site is important. OP's can often reach places which are inaccessible to radars, but it is desirable to choose positions with easy access in order to facilitate supply, mess, administration, maintenance, and rotation of personnel. OP's must be trained to be as nearly self-sufficient in the field as possible but should be given all possible assistance in order to maintain a high order of morale and discipline.

e. Security. Local security for an OP is largely a matter of training. Normally, each OP is responsible for its own protection. However, if an OP can be sited within an existing perimeter defense or can be withdrawn to one during the hours of darkness, it is recommended that this be done. In areas where infiltrators or guerillas are active, OP's should not be left in position during hours of darkness. At times, these conditions may preclude the use of OP's at any time. When such activity is nonexistent or rare, and aerial activity is of such a nature that the OP will provide useful warning, or the OP is filling a gap in the radar coverage, sites may be

occupied during hours of darkness or poor visibility.

67. Personnel

a. Qualifications. It is imperative that the limiting effect of the human element be considered in the establishment, maintenance, and operation of the OP system. Superior training and discipline are essential for optimum results. Each OP consists of a three-man team and each man must be competent in all of the following:

- (1) Aerial observation and aircraft recognition.
- (2) Radio and vehicle operation and maintenance.
- (3) Pioneering and camouflage of field position.
- (4) Field cooking, personal hygiene, first aid, and map reading.
- (5) Personal defense against infiltrators.

b. Duties Upon Occupation of Position.

- (1) Upon occupation of the OP position each member of the OP team will—
 - (a) Familiarize himself with the surrounding terrain.
 - (b) Take necessary steps to prepare the position for comfortable, safe, efficient operation.
 - (c) Check personal supplies and equipment.
- (2) Upon occupation of the OP position the senior observer will—
 - (a) Report the OP on the air.
 - (b) Establish a roster for observation.
 - (c) Check all items of equipment belonging to the team.

- (d) Direct and help each team member in the accomplishment of items listed in (1) above.

68. Reporting

Instantaneous observation and reporting of all aerial activity are vital to the efficient operation of the AAAIS OP system. Detailed information is desirable but the limited amount of warning time available from OP's dictates immediate transmittal of available information. Observers will report all airborne objects in the following sequence (code designations may be used where appropriate, and unknown items will be omitted):

<i>Initial</i>	<i>Example</i>
(1) Alerting signal-----	"Flash,"
(2) Number of airborne objects--	"Many,"
(3) Identification-----	"Hostile,"
(4) Direction of flight with reference to OP's position.	"Crossing right (or crossing left or incoming),"
(5) OP location*-----	"2 o'clock,"
(6) Closing-----	"Out."

69. Continual Evaluation

Continual evaluation of the efficiency of the AAAIS OP system must be conducted. Changes should be made whenever they will contribute to the AA defense mission.

*This system is based on the assumption that individual OP's have assigned hours of the clock designation based on their location. Each of the individual fire units must be oriented in accordance with this plan. Regardless of target location relative to the OP, the OP will always report in terms of target clock position.

Section V. OPERATION OF AAOC

70. Collection and Evaluation of Information

Depending upon its location (zone of interior, communication zone, or field army area), the AAOC will receive information from three primary sources—the Air Force, AAAIS radars, and AAAIS OP's.

a. The early warning which is received from the Air Force is transmitted to the AAOC by the AALO or one of his team stationed at the appropriate Air Force agency (pars. 53 through 57). The AAOC may be connected to one or more Air Force agencies, depending upon the expected value of the information to be received from each and the communications available. For each agency there is a plotter in the AAOC who is connected by direct communication to the teller at the appropriate Air Force agency. Information received concerning approaching targets is plotted on the situation board or in the early warning rings on some operations boards (AN/MTQ-1). This initial location information is recorded as a plot, and next to it or on a separate data display board are recorded pertinent details which the warning source is able to offer. Each target so recorded is assigned a target number which serves to identify it for the remainder of the engagement. When further location information is received, the plot becomes a track and continues to be recorded until it is at a sufficiently close range to be picked up by the AAAIS radar and plotted on the operations board. The track may then be erased from the situation board to make room for new ones. The AALO should thereupon be advised to cease telling on that track.

b. Each AAAIS radar is connected directly to a plotter at the operations board in the AAOC. This plotter records as a track all target information which he receives from his radar(s). This track display may take any of the several forms described in chapter 3. All targets which are observed on the PPI scope will be reported, and telling will cease on targets as directed by the AAOC.

c. Information provided by AAAIS observation posts is transmitted directly to the AAOC as well as to the fire units immediately concerned. At the AAOC it is recorded by an OP flash recorder who monitors the OP net. He displays this information on a separate board, such as the OP flash board or the auxiliary data display board found in the AN/MTQ-1. The form used to display this information will vary. The OP warning remains on display in the AAOC long enough to permit the AAOO to make note of it and direct appropriate action. It is then erased.

d. The evaluation of information received in the AAOC is accomplished by the AADC or his representative, the AAOO. Although much of the transmission of information from the Air Force, the OP's, and the surveillance radars may seem routine, the AAOO does bear serious responsibilities of evaluation. This is primarily true in the area of aircraft identification. Although the Air Force bears primary responsibility for identification, it is a function that must be carried on at all levels of command. The AAOO must be certain that targets transferred to the operations board are correlated with targets previously displayed on the situation board, and that they are positively identified. He can do this,

for example, through the use of flight plans, established flight corridors, or IFF. All echelons must conduct the same evaluation, based upon information received from the AAOC and from their own radars. Only when information has been properly evaluated may it be treated as intelligence and then acted upon.

71. Dissemination of Intelligence

a. Target information is disseminated to units subordinate to the AAOC by the intelligence teller, who is in direct communication with the lower echelons. In the AAOC, he is located in a place which affords a clear view of the various display boards. This teller immediately transmits to lower echelons information on all plots as they appear on the operations board, and he will tell as many plots as possible on all tracks. OP flash warnings are noted by the AAOO, and, if appropriate, may be disseminated to units other than those which directly received the warning.

b. The AAOO disseminates over the operational control net conditions of air defense warning, action status, IFF code changes, special flight regulations of interest to AAA, identification of aircraft, and other essential elements of information which the Air Force warning agency reports. In defenses where large numbers of units are involved, the dissemination of this information may necessitate additional communication lines from the AAOC. This will result in a number of operational control nets controlled by the AAOO but manned by other personnel in the AAOC.

c. In order for intelligence disseminated by the AAOC to have any real value at lower levels, these echelons must be capable of understanding its meaning correctly and acting upon it confidently. Thus, all lower levels must possess plotting equipment gridded in the appropriate position referencing grid, whether it be a plotting board in an information operations center, an antiaircraft fire control system AAFCS M33 early warning plotting board, or merely a grid overlay on a PPI scope. The combined use of a common grid system and target numbers will make target designation by the AAOC accurate. Only by the correct use of such facilities can disseminated intelligence be properly utilized.

72. Fire Direction

a. Fire direction is a responsibility of the AADC and a function of the AAOO. Local SOP's issued by the AADC will govern its exercise. Fire direction includes, but is not limited to, selection of targets, the concentration or distribution of fire, the allocation of ammunition, and direction as to the engagement or disengagement of targets. It must be remembered that the correct exercise of the function of fire direction from an AAOC is dependent on the proper execution of the prior functions of collecting and evaluating information and disseminating intelligence.

b. The operations board will portray graphically the location of units of the defense, the range capabilities of these units, and their primary sectors of fire. The status board(s) will display the operability and condition of readiness of each AA unit

under the AAOC. Noting this information as each track approaches the vulnerable area, the AAOO, acting within local SOP, will tell the fire unit or sector which targets it will engage. This can most easily be done by designation through the use of previously assigned target numbers. The AAOO should strive to bring fire on all targets, weighting the fire, where possible, against the targets which present the greatest threat to the defended area. The length of engagement time for each target will depend upon the range of the weapons, engagement of a more profitable target, or the conservation of ammunition, as directed by local SOP or the AAOO. All fire direction orders will be transmitted to the fire units from the AAOC over the operational control net.

c. The function of fire direction may be delegated from the primary AAOC according to the orders of the AADC. It may be delegated to subordinate AAOC's as an implementation of the sector control plan (par. 52). It may also be delegated to units as low as the battalion echelon if the AADC so directs. These units will then engage targets at their own discretion, using information displayed on their boards as received from the AAOC. Decentralization of control increases the requirement for immediate and complete dissemination of information and intelligence upon which to base selection of targets.

APPENDIX I

REFERENCES

AR 350-15..... Military Training Aids
 DA Pam 108-1... Index of Army Motion Pictures,
 Television Recordings, and
 Filmstrips
 SR 310-20-(series) Military Publications
 SR 320-5-1..... Dictionary of United States Army
 Terms
 SR 320-50-1..... Authorized Abbreviations
 FM 5-20..... Camouflage, Basic Principles
 FM 5-20C..... Camouflage of Bivouacs, Com-
 mand Posts, Supply Points,
 and Medical Installations
 FM 6-20..... Artillery Tactics and Techniques
 FM 21-5..... Military Training
 FM 21-8..... Military Training Aids
 FM 21-25..... Elementary Map and Aerial
 Photograph Reading
 FM 21-26..... Advanced Map and Aerial Photo-
 graph Reading
 FM 21-30..... Military Symbols
 FM 21-80..... Recognition Training
 FM 24-20..... Field Wire Technique
 FM 30-5..... (Classified)

FM 31-15..... Operations Against Airborne At-
 tack, Guerilla Action, and In-
 filtration
 FM 31-35..... Air-Ground Operations
 FM 44-1..... Antiaircraft Artillery Employ-
 ment
 FM 44-2..... Antiaircraft Artillery Automatic
 Weapons
 FM 44-4..... Antiaircraft Artillery Guns
 FM 100-5..... Field Service Regulations, Opera-
 tions
 FM 100-10..... Field Service Regulations, Ad-
 ministration
 FM 100-11..... Signal Communications Doctrine
 FM 101-5..... Staff Officers' Field Manual—
 Staff Organization and Proce-
 dure
 FM 101-10..... Staff Officers' Field Manual—
 Organization, Technical, and
 Logistical Data
 TM 5-236..... Surveying Tables
 TM 5-241..... The Universal Grid System (Uni-
 versal Transverse Mercator)
 and (Universal Polar Stereo-
 graphic)
 TM 11-448..... Operations Center AN/TTQ-2
 TM 11-2581..... Plotting Equipment AN/TSA-1
 TM 11-2582..... Plotting Equipment AN/TSA-2
 TM 44-225..... Orientation for Artillery
 ACP 125 (A)..... (Classified)
 ACP 165..... (Classified)

APPENDIX II

GLOSSARY

Acquisition radar—A radar of lesser range capabilities than a surveillance radar but of greater inherent accuracy, the normal function of which is to acquire aerial targets, either by independent search or on direction of the surveillance radar, and to electronically transfer these targets to tracking radars.

Adjacent AAOC's—AAOC's which are geographically proximate and on the same level in the chain of command.

Airborne early warning (AEW)—Airborne radar equipment providing long-range detection and identification, and relaying of the radar signals to ground or airborne station.

Aircraft control and warning (AC&W)—Either groups, squadrons, or detachments, which provide the personnel and equipment necessary to organize and operate control centers, direction centers, and surveillance stations.

Air control center (ACC)—A principal air control facility from which all aircraft and air warning functions of tactical air operations are supervised and directed.

Air control team (ACT)—A team especially organized to direct close air support strikes in the vicinity of

forward ground elements by visual or other means. It is a highly mobile element having air-ground communication to vector aircraft to targets, and point-to-point communications with the air control center or pertinent control and reporting centers.

Air Defense Command (ADC)—A major command of the United States Air Force charged with the defense of the United States against air attack. This agency is responsible for the formulation in conjunction with the Army Antiaircraft Command, of the overall air defense plan for the United States.

Air defense filter center—A civilian installation which is the principal control agency in a filter center area for collecting ground observer reports from ground observer posts. The filter center transmits the filtered aircraft movement information to appropriate direction centers and adjacent filter centers.

Air defense forces—Subordinate commands of the Air Defense Command which are responsible for the air defense of their respective regions. They are the Eastern, Central, and Western Air Defense Forces.

Air defense identification zone (ADIZ)—Airspace of defined dimensions within which the ready identification, location, and control of aircraft are required. These zones are delineated in radio facility charts or other appropriate military regulations.

Air defense restricted area—An area or air space in which there are special restrictive measures employed to prevent or minimize interference

between friendly forces. Air defense restricted areas are as follows:

Gun defended area (GDA)—The zone and the air space above it which is denied to friendly aircraft except under certain specified conditions.

Inner artillery zone (IAZ)—A specified air space within a gun-defended area which is denied to friendly aircraft under all conditions.

Air division (defense)—A subordinate command of an air defense force. The air division (defense) commander exercises operational control of units designated for air defense operations within a sector, and is responsible for all air defense operations conducted therein.

Alternate AAOC—An AAOC subordinate to the primary AAOC which will assume its functions in the event that the primary AAOC is destroyed or rendered inoperable.

Antiaircraft artillery action status—The degree of fire restriction (engagement control) imposed upon AAA employed in air defense. Action status terms are as follows:

a. **GUNS FREE.** Fire at any aircraft not identified as friendly.

b. **GUNS TIGHT.** Fire only at aircraft identified as hostile.

c. **HOLD FIRE.** Do not open fire. Cease fire.

Antiaircraft artillery information service (AAAIS)—

An organized service established by antiaircraft artillery units for obtaining information of aerial activity with which to warn fire units of the antiaircraft artillery defense. It includes radars and

observers and necessary communications facilities.

Antiaircraft artillery operations detachment (AAAOD)

An organization of officer and enlisted men used to establish and operate the antiaircraft operations center.

Antiaircraft defense—All ground-to-air or ship-to-air action that includes antiaircraft guns, automatic weapons, rockets, ground-to-air and ship-to-air guided missiles, and antiaircraft artillery information service.

Antiaircraft defense commander (AADC)—For each AA defended area there will be an AA defense commander. This commander is the senior (or designated) antiaircraft artillery officer present. As AA defense commander, he exercises tactical control under the operational control of the appropriate air defense commander over all elements in the AA defense.

Antiaircraft operations center (AAOC)—The tactical headquarters of an AA defense commander. It is the agency provided for the collection and evaluation of information and the dissemination of intelligence to units within an AA defense, and through which tactical control over subordinate units of the defense is exercised.

Army Antiaircraft Command—The command parallel to the Air Defense Command established by the United States Army to command all Army antiaircraft forces allocated to the air defense of the United States.

Auxiliary data display board—A board in the AN/MTQ-1 operations center used to display information such as OP flash messages and track data.

Chief plotter—A noncommissioned officer stationed in the AAOC who, in addition to specific duties pertaining to data display, supervises the activities of all enlisted personnel on duty in the AAOC.

Combat operations center (COC)—In CONUS, the command post of the Air Defense Command, the Air Defense Forces, and Air Division Commanders in which the intelligence for committing the forces provided for air defense of the territory, region, or sector is collected and evaluated. The center is primarily concerned with the plans and the execution of broad policy rather than minute-to-minute instructions.

Condition of air defense warning—An air defense warning alert issued to all interested agencies in an area (Army, Navy, Air Force, and civilian). The Air Force is responsible for this announcement through the control center. In the United States, three signals are used—

- a. *Warning RED*—attack by hostile aircraft is imminent.
- b. *Warning YELLOW*—attack by hostile aircraft is probable.
- c. *Warning WHITE*—(all clear) attack by hostile aircraft is improbable.

Conditions of readiness—All AAA units operationally prepared to engage a hostile air attack will maintain one of the following conditions of readiness (issued by the AAOC):

- a. *Battle stations*. Applicable when attack is imminent or in progress.

- b. *Standby*. Applicable when attack is probable, but the defended area is not immediately threatened.

- c. *Secure*. Applicable when available information indicates attack is not probable or imminent. The minimum condition of readiness.

Control and reporting center (CRC)—A subordinate air control facility of the air control center from which air control and air warning operations within its area of responsibility are conducted.

Control center—The principal air operations installation (land-based) from which all aircraft, antiaircraft artillery, ground-to-air missiles, and air warning functions of an active air defense area are coordinated.

Direction center—An air operations installation (land-based), subordinate to the control center, from which aircraft, antiaircraft artillery, surface-to-air guided missiles, and air warning functions of an active subsector are controlled.

Early warning rings—Three rings circumscribed on the outer perimeter of the operations board in the operations center AN/MTQ-1 which are used to display early warning information.

Electronics countermeasures (ECM)—Those activities designed to restrict, counteract, or interfere with the use of radar or radio, or to confuse operators thereof; radiation or reradiation of electromagnetic waves in a manner intended to interfere with the interpretation of data received by electronic equipment.

Ground observer post (GOP)—A position, manned by volunteer civilians, from which visual surveillance of the surrounding area is possible. The GOP constitutes the initial point from which aircraft movement information is transmitted to air defense filter centers.

Ground observer team (GOT)—Small units or detachments deployed to provide information of aircraft movements over a defended area, obtained either by aural or visual means.

Identification—The determination of an aircraft's friendly or enemy character by any means or combination of means, including visual recognition, flight plan correlation, electronic interrogation, or track behavior.

Information AAOC—A lower echelon operations center, generally established at headquarters down to and including battalion, the function of which is to keep the unit commander and his staff informed of the general air defense situation.

Intelligence teller—A teller stationed in the AAOC who transmits pertinent aircraft track information displayed on the operations board to the elements of the defense.

Operations journal—The military record of AAOC activities.

Plotters—Enlisted men stationed in the AAOC who are directly connected by wire or radio to one or more surveillance radars and who record and display pertinent track information received from that radar or radars.

Primary AAOC—The AAOC of the senior AA defense commander when subordinate AAOC's are established to control local defenses within the area of responsibility of the senior AA defense commander.

Prohibited areas—Prohibited areas as delineated on USAF navigational maps are those air space reservations in which aircraft are prohibited at all times.

Recognition—Visual determination through appearance or behavior of the hostile or friendly nature of an aircraft.

Status board—A board or boards located in the AAOC upon which is posted information showing the operational status of all units of the command and other miscellaneous data pertaining to the operation of the AAOC.

Subordinate AAOC—An AAOC established to control local AA defenses under the direction and supervision of a primary AAOC.

Surveillance station—An Air Force radar installation having the capability of extending the functions assigned to a direction center.

Target director post (TDP)—A special control element of the tactical air control system. It performs no air warning service, but is used to position friendly aircraft over predetermined target coordinates or other geographical locations under all weather conditions.

Track—A series of related contacts displayed on a plotting board which represent the path of flight of an aircraft.

INDEX

	<i>Paragraphs</i>	<i>Page</i>
Acquisition radar.....	29, 32, 59	47, 49, 76
Action Status.....	7, 24, 26, 71	6, 28, 38, 89
Adjacent antiaircraft operations centers.....	17, 24	21, 28
Aerial photographs.....	16	14
After-action report, antiaircraft artillery.....	25	33
Airborne early warning (AEW).....	54	69
Air control center (ACC).....	14, 16	13, 14
Air control team (ACT).....	16, 17	14, 21
Air controller, forward (Air Force).....	17	21
Aircraft recognition and identification signals.....	26	38
Air defense filter center.....	54	69
Air defense forces.....	54	69
Air defense restricted area.....	13	11
Air division (defense).....	11, 54	8, 69
Air Force:		
Communications.....	10-13, 15-16	8-11, 14
Liaison agencies.....	10-16	8-14
Liaison services.....	7, 10, 24, 25, 27, 71	6, 8, 28, 33, 46, 89
Operation of liaison with AAOC-AAAIS.....	53-57, 70	68-71, 87
Responsibilities for air defense.....	4, 11	5, 8
Tactical air force.....	14, 16	13, 14
Air-ground section (of JOC).....	16	14
Alternate antiaircraft operations center.....	21, 49, 52	25, 63, 66
AN/GRC-9 radio set.....	31	48
AN/GSS-1 electronic search central.....	24	28
AN/MTQ-1 operations center.....	23-26, 70	26-38, 87

	Paragraphs	Page
Antiaircraft artillery (AAA):		
Employment in air defense role-----	5, 56	5, 70
Employment in surface role-----	17	21
Matériel status-----	24, 26	28, 38
Organic sources of information-----	28	47
Release of fire-----	16	14
Training-----	19	24
Antiaircraft artillery action status-----	7, 24, 26, 71	6, 28, 38, 89
Antiaircraft artillery after-action report--	25	33
Antiaircraft artillery information service (AAAIS):		
General-----	1, 21, 27, 51	3, 25, 46, 65
Communications-----	33-45, 58, 66	51-59, 74, 83
Equipment-----	29, 31, 32	47, 48, 49
Establishment-----	27, 28	46, 47
Personnel-----	27, 28, 30, 51, 67	46, 47, 48, 65, 85
Observation posts (OP's):		
General-----	29, 65, 70	47, 82, 87
Capabilities and limitations-----	31, 66	48, 83
Continual evaluation-----	69	86
Local security-----	31, 66	48, 83
OP net-----	37, 43, 44, 66, 67, 70	53, 57, 58, 83, 85, 87
Personnel-----	67	85
Reporting-----	68, 70	86, 87
Siting-----	66	83
Warning-----	24, 27, 29, 66, 70	28, 46, 47, 83, 87
Radars:		
General-----	29, 51, 58-64, 70	47, 65, 74-81, 87

	Paragraphs	Page
Antiaircraft artillery information service (AAAIS)—Continued		
Radars—Continued		
Acquisition radar, use-----	59	76
Capabilities and limitations-----	32	49
Defense of radars-----	62	79
Gaps in defense-----	29, 31, 32, 65	47, 48, 49, 82
Griding of PPI scopes-----	60, 64	77, 81
Orientation and calibration-----	61, 64	79, 81
Primary sectors-----	63, 64	81
Radar reporting net-----	26, 37, 44, 58, 66	38, 53, 58, 74, 83
Schedules-----	26	38
Siting-----	58	74
Telling-----	64, 70	81, 87
Warning-----	24-27, 56, 70	28-46, 70, 87
Antiaircraft artillery operations detachment (AAAOD):		
General-----	18, 47, 51, 52	23, 61, 65, 66
Equipment-----	23, 24	26, 28
Mission-----	22	26
Personnel-----	25, 51	33, 65
Antiaircraft defense commander (AADC)---	18-21, 25, 28, 36, 37, 49-52, 56, 58, 65, 70, 72	23-25, 33, 47, 52, 53, 63-66, 70, 74, 82, 87, 90
Antiaircraft fire control system (AAFCS) M33-	29, 32, 71	47, 49, 89
Antiaircraft operations center (AAOC):		
General-----	1, 18-21, 27, 33, 48-52	3, 23-25, 46, 51, 62-66

	<i>Paragraphs</i>	<i>Page</i>
Antiaircraft operations center (AAOC)—Con.		
Adjacent AAOC's	17, 24	21, 28
Alternate AAOC	21, 49, 52	25, 63, 66
Classification security	50	64
Communications	33-45, 49, 51, 52, 71	51-59, 63, 65, 66, 89
Equipment	23, 24, 51	26, 28, 65
Establishment	20, 49	24, 63
Field army AAOC	14	13
Fire direction	25, 72	33, 90
Flexibility	48	62
Functions	19, 72	24, 90
Information AAOC	21, 24, 52, 71	25, 28, 66, 89
Liaison with—		6, 87
Air Force	7, 10-16, 19, 46, 53-57, 70	6, 8-14, 24, 60, 68-71, 87
Navy	8, 19, 46	7, 24, 60
Other Army agencies	9, 17, 19, 46	7, 21, 24, 60
Local security	49	63
Location	49	63
Operation	70-72	87-90
Personnel	22, 25, 50, 51	26, 33, 64, 65
Primary AAOC	20, 21, 52, 72	24, 25, 66, 90
Staff coordination	47, 48, 51	61, 62, 65
Subordinate AAOC	21, 52, 72	25, 66, 90

	<i>Paragraphs</i>	<i>Page</i>
Antiaircraft operations officer (AAOO)	25, 26, 37, 50, 51, 56, 70, 72	33, 38, 64, 65, 70, 87, 90
Antiaircraft liaison officer (AALO)	53, 55-58, 70,	68, 70- 74, 87
Antiaircraft liaison journal	55, 56	70
Antiaircraft liaison team	53, 55-57	68, 70-71
Antiaircraft teller	55-57	70-71
AN/TPS-1D radar set	24, 26, 29, 32	28, 38, 47, 49
AN/TSA-2 plotting equipment	24	28
AN/TTQ-2 operations center	23, 24	26, 28
Army (field) AAOC	14	13
Army responsibility for air defense	5	5
Assistant antiaircraft liaison officer	56	70
Assistant antiaircraft operations officer	25, 51	33, 65
Atomic attack	43, 49	57, 63
Auxiliary data display board	24-26, 70	28-38, 87
Call signs	38	55
Call words	38, 46	55, 60
Chief plotter	25	33
Combat information center (CIC)	8	7
Combat operations center	10-13, 54	8-11, 69
Combat operations section (of JOC)	16	14
Command net	37, 44	53, 58
Communications (<i>see also</i> Radio nets and Wire communication):		
General	1, 33, 34, 49, 51, 58, 70	3, 51, 63, 65, 74, 87
Adjacent AAOC's, communication with	17, 52	21, 66
Air Force communications	10-13, 15, 16	8-11, 14
AAOC-Air Force	15, 37, 44	14, 53, 58

	Paragraphs	Page
Communications—Continued		
AAOC—AAAIS.....	33-45, 49, 52, 58, 71	51-59, 63, 66, 74, 89
AAOC, communications within the...	24, 25, 71	28, 33, 89
Coordination of communication activ- ities.....	36	52
Establishment.....	35	52
Messenger.....	34	51
Nets.....	1, 33, 37	3, 51, 53
Radio supplementing wire.....	41	56
Security.....	38, 40	55, 56
Supervision.....	42	57
Condition of—		
Air defense warning.....	7, 13, 24-26, 71	6, 11, 28-38, 89
Readiness.....	24-26, 72	28-38, 90
Control and reporting center (CRC).....	14, 16	
Control and reporting post (CRP).....	16	13, 14 14
Control center.....	10-15, 54	8-14, 69
Controller, forward air (Air Force).....	17	21
Conversion board.....	60	77
Corridors (flight).....	70	87
Coordinate conversion.....	60	77
Defense commander, antiaircraft (AADC)...	18-21, 25, 28, 36, 37, 56, 58, 65, 70, 72	23-25, 33, 47, 52, 53, 70, 74, 87, 90
Direction center.....	10, 12-15, 54, 57	8, 10- 14, 69, 71

	Paragraphs	Page
Display board radar data PT/171/PTS.....	24	28
Division, air (defense).....	11, 54	8, 69
Early warning.....	7, 24-27, 53, 57, 70	6, 28- 46, 68, 71, 87
Early warning net (Air Force).....	26, 37, 70	38, 53, 87
Early warning plotter.....	25, 57	33, 71
Early warning rings. (See operations center AN/MTQ-1.)		
Electronic countermeasures (ECM).....	13, 32	11, 49
Electronic search central, AN/GSS-1.....	24	28
Filter center, air defense.....	54	69
Fire direction (AAA).....	25, 72	33, 90
Fire support coordination center (FSCC).....	17	21
Flight corridors.....	70	87
Flight plans.....	7, 70	6, 87
Forces, air defense.....	54	69
Forward air controller (Air Force).....	17	21
Glossary.....	App II	94
Grid:		
Georef.....	46, 57	60, 71
Military grid.....	46, 57	60, 71
Universal Transverse Mercator (UTM).....	46	60
Universal Polar Stereographic (UPS).....	46	60
Gridding of PPI scopes.....	60, 64	77, 81
Ground observer post.....	11, 24	8, 28
Ground observer team (GOT).....	16	14
Guerillas.....	49, 62, 66, 67	63, 79, 83, 85
Identification.....	7, 13, 25, 26, 32, 56, 57, 64, 67, 68, 70, 71	6, 11, 33, 38, 49, 70, 71, 81, 85, 86, 87, 89

	Paragraphs	Page
Identification, friend or foe (IFF).....	7, 32, 64, 70, 71	6, 49, 81, 87, 89
Information AAOC.....	21, 24, 52, 71	25, 28, 66, 89
Information board.....	26	38
Intelligence net.....	37, 44, 71	53, 58, 89
Intelligence teller.....	25, 71	33, 89
Joint operations center (JOC).....	14, 16	13, 14
Kit, Georef grid overlay.....	60	77
Liaison. (See Air Force; Antiaircraft liaison journal; Antiaircraft liaison officer; Antiaircraft liaison team; Antiaircraft operations center; and Navy.)		
Liaison net (Air Force).....	37, 44	53, 58
Mass tracks (multiple and stream).....	57	71
Marine Corps:		
Antiaircraft support.....	8	7
Coordination with AAOC.....	46	60
Responsibility for air defense.....	6	6
Military grid reference system.....	46, 57	60, 71
Movements and identification officer (Air Force).....	56	70
Navy:		
Antiaircraft support.....	8	7
Liaison with Air Force.....	12, 13	10, 11
Liaison with AAOC.....	8, 46	7, 60
Responsibility for air defense.....	6	6
Nets. (See Radio nets.)		
Net call.....	38	55
Net control station.....	38	55
Observation post. (See Antiaircraft artillery information service.)		

	Paragraphs	Page
OP flash board.....	24, 25, 70	28, 33, 87
OP flash recorder.....	25, 70	33, 87
OP net.....	37, 43, 44, 66, 67, 70	53, 57, 58, 83, 85, 87
Operational control net.....	37, 44, 71, 72	53, 58, 89, 90
Operations board.....	24-26, 70, 72	28-38, 87, 90
Operations center AN/MTQ-1.....	23-26, 70	26-38, 87
Operations center AN/TTQ-2.....	23, 24	26, 28
Operations detachment. (See Antiaircraft artillery operations detachment.)		
Operations journal.....	25	33
Operations journal recorders.....	25	33
Overlay, PPI grid.....	60, 61, 64	77, 79, 81
Photographs, aerial.....	16	14
Plan position indicator (PPI) scope.....	32, 60, 63, 64, 70, 71	49, 77, 81, 87, 89
Plotters (see also Early warning plotter; and Chief plotter).....	25, 64, 70	33, 81, 87
Plotting:		
Air Force.....	54, 57	69, 71
AAOC.....	24-26, 46, 64, 70, 71	28-38, 60, 81, 87, 89
Plotting equipment AN/TSA-2.....	24	28
PPI scope.....	32, 60, 63, 64, 70, 71	49, 77, 81, 87, 89
Primary AAOC.....	20, 21, 52, 72	24, 25, 66, 90
PT/171/PTS display board radar data.....	24	28

	Paragraphs	Page
Radar. (See Acquisition radar; AAAIS; and Surveillance radar.)		
Radar reporting net.....	26, 37, 44, 58, 66	38, 53, 58, 74, 83
Radar set AN/TPS-1D.....	24, 26, 29, 32	28, 38, 47, 49
Radar teller.....	64	81
Radio nets:		
General.....	26, 37-43	38, 53- 57
Air Force liaison net.....	37, 44	53, 58
Command net.....	37, 44	53, 58
Early warning net (Air Force).....	26, 37	38, 53
Intelligence net.....	37, 44, 71	53, 58, 89
Liaison nets.....	37, 44	53, 58
OP net.....	37, 43, 44, 66, 67, 70	53, 57, 58, 83, 85, 87
Operational control net.....	37, 44, 71, 72	53, 58, 89, 90
Radar reporting net.....	26, 37, 44, 58, 66	38, 53, 58, 74, 83
Radio set AN/GRC-9.....	31	48
Radio silence.....	40	56
Radiotelephone procedure.....	39, 46	56, 60
References.....	App I	92
Responsibility for air defense.....	4-6	5-6
Restricted area, air defense.....	13	11
Schedules, radar.....	26	38
Sector (air defense).....	11, 12	8, 10
Sector control.....	21, 52, 72	25, 66, 90
Security. (See AAAIS; AAOC; and Commu- nication.)		
Senior director (controller) (Air Force).....	56	70

	Paragraphs	Page
Situation board.....	24-26, 70	28-38, 87
Status board.....	24-26, 72	28-38, 90
Subordinate AAOC.....	21, 52, 72	25, 66, 90
Subsector (air defense).....	12, 13, 57	10, 11, 71
Surveillance radar (see also AAAIS).....	24- 26, 29, 32, 58-64, 70	28-38, 47, 49, 74-81, 87
Surveillance screen, air.....	57	61
Surveillance station.....	54	69
Tactical air force.....	14, 16	13, 14
Target director post (TDP).....	14, 16	13, 14
Target numbers.....	70-72	87-90
Track designator.....	57	61
Track stand.....	25, 26, 57	33, 38, 61
Tracks (see also Mass tracks).....	25, 26, 56-67, 70-72	33, 38, 70-85, 87-90
Transmission security.....	40	56
Universal Polar Stereographic Grid.....	46	60
Universal Transverse Mercator Grid.....	46	60
Wire communication:		
General.....	34, 37, 41, 43, 49	51, 53, 56, 57, 63
Commercial facilities.....	43	57
Methods of installation.....	45	59
Responsibility for laying.....	44	58
World geographic reference system (Georef).....	46, 57	60, 71

[AG 323.3 (19 Nov 54)]

BY ORDER OF THE SECRETARY OF THE ARMY:

M. B. RIDGWAY,
General, United States Army,
Chief of Staff.

OFFICIAL:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

DISTRIBUTION:

Active Army:

Tech Svc, DA (1)	FA Bn (2)
Admin & Tec Svc Bd (2)	AAA Btry (2)
AFF (25)	FA Btry (2)
Army AA Comd (5)	USMA (10)
OS Maj Comd (10)	CGSC (10)
OS Base Comd (5)	Gen & Br Svc Sch (5)
MDW (1)	AAA Sch (25)
Armies (20)	FA Sch (15)
Corps (3)	PMST AAA ROTC units (2)
Div (5)	PMST FA ROTC Units (2)
Tng Div (2)	Mil Dist (2)
AAA Brig (10)	Units organized under following
AAA Gp (10)	TOE's:
FA, Gp (2)	44-7, AAA Opr Det (5)
AAA Bn (5)	

NG: Same as Active Army except allowance is two copies to each unit.

USAR: Same as Active Army except allowance is two copies to each unit.

Unless otherwise noted, distribution applies to ConUS and overseas.

For explanation of abbreviations used, see SR 320-50-1.